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MANUAL OF DISEASES

OF THE

EAR, NOSE AND THROAT

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MANUAL OF DISEASES

OF THE

EAR, NOSE AND THROAT

BY

JOHN JOHNSON KYLE, B.S., M.D.

Professor of Clinical Otology, Rhinology and Laryngology in the Medical College of Indiana, Department of Medicine of Purdue University; Otologist, Rhinologist and Laryngologist to City Hospital, St. Vincent's Hospital and City Dispensary, Indianapolis; Fellow of the American Academy of Ophthalmology and Oto-Laryngology and Fellow of the American Laryngological, Rhinological and Otological Society; Member of the Association of Military Surgeons of the United States; Late Major and Surgeon, U. S. Vol.

SECOND EDITION
REVISED AND ENLARGED

WITH 169 ILLUSTRATIONS

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PREFACE TO SECOND EDITION.

The author desires to acknowledge his appreciation of the kind manner in which the first edition of his book was received by the medical press and public, and the fact that a new printing has been called for within eighteen months.

Certain sections of the work have been revised, and new subject matter added. It seems necessary at this time to add a chapter on diseases of the trachea and bronchi. The aptitude of the trained laryngologist in this special field makes it the logical duty of every physician interested in laryngology to fully understand the medical and surgical treatment of the lower air passages, especially the trachea and bronchi. It has been our effort to recognize certain limitations and consider only those affections which should, in our judgment, come within the domain of the laryngologist. The invention of the bronchoscope, and the perfection of the technique of bronchoscopy by Killian must be acknowledged by all as the greatest of medical triumphs. By this instrument, compression from extrinsic causes, such as the thyroid or thymus gland, can be detected by way of the natural channel, as well as intrinsic tumors, diverticuli, ulcerations, deformities, malignant neoplasms, and foreign bodies, heretofore impossible of accurate diagnosis and treatment.

John J. Kyle.

Indianapolis, Indiana,
July, 1907.

PREFACE TO FIRST EDITION.

It has been the effort of the author in the succeeding pages to give to the student and general practitioner of medicine part of the essential information relative to diseases of the ear, nose and throat. The methods of treatment, seemingly somewhat dogmatic, are those which, from personal observation, have been most successful.

In the preparation of the embryology, the text-books of McMurrich and Heisler have been followed very closely.

The pathology of the upper air passages has been given special attention and the sub-divisions and classification of tumors are in accordance with the teaching of Langerhans. The author has also quoted freely from Zeigler, Warren, Thayer, Orth and Senn.

Special acknowledgment is made to the following well-known authors: Politzer, Gruber, Gruenwald Turner, Killian, Grunert, Burnett, Knight, D. Braden Kyle, Shurley, Hovell, Bosworth, Coakley, Grayson, Bishop, Dench, Bacon and Whiting.

The numerous journals devoted to the diseases of the ear, nose and throat have been freely consulted, and much of the contents herein have been gleaned from this prolific source of valuable information.

The thanks of the author are due to Dr. Helen Knabe for assistance in the preparation of the original illustrations and to Dr. Jane M. Ketcham for aid in the correction of proof.

John J. Kyle.

226 Newton Claypool Building,
Indianapolis, Indiana.

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DISEASES OF THE EAR, NOSE AND THROAT.

CHAPTER I.

EMBRYOLOGY OF THE EAR, NOSE AND THROAT.

To appreciate the fully developed ear, nose and throat of man, it is necessary for a brief reference to be made to those organs as embryological structures. The three germinal layers from which the structures of the body develop, are the ectoderm, endoderm and mesoderm.

From the ectoderm is developed the mucous membrane lining of the mouth, nasal cavity, pharynx, Eustachian tubes, middle ear, mastoid antrum, digestive and respiratory tracts. The larynx is lined with epithelium from the endoderm. The cartilaginous portion of the nose, larynx and ear, and the bony structure of the nose and ear are derived from the mesoderm.

During the very early development of the embryo as it rests upon the yolk-sac, the oral fossa is observed to be a well-marked depression, slightly behind and below the head region. In the floor of the oral fossa are found the branchial arches which have a direct influence upon the arrangement of the organs of the head. Some of the branchial arches are converted into the special organs and others disappear.

Internal Ear.—The internal ear is the first portion of the ear to be formed. It takes its origin, as described by Heisler, from a circular patch of ectoderm on the dorso-lateral surface of the head region of the embryo near the dorsal termination of the first visceral furrow. By a process of shrinkage from the surface of the ectoderm, the edges

detach themselves and, in a short time come together and form the otic vesicle or otocyst, from which develops the membranous labyrinth. The small prolongation (Fig. 2) on the dorsal surface of the otocyst develops and forms the ductus endolymphaticus. By a process of enfolding and constriction of the two extremities of the otic vesicle, the semicircular canals and cochlear duct are formed,

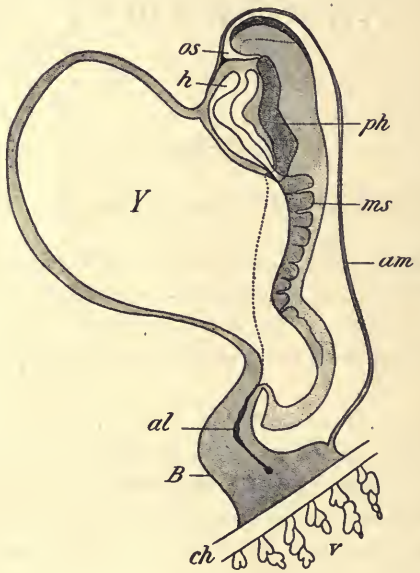

FIG. 1.—RECONSTRUCTION OF THE EMBRYO 2.11 MM. LONG.

al, Allantois; *am*, amnion; *B*, belly-stalk; *ch*, chorion; *h*, heart; *ms*, mesodermic somite; *os*, oral fossa; *ph*, pharynx; *v*, chorionic villi; *Y*, yolk-sac. (After *Eternod and McMurrich.*)

the latter finally becoming the cochlea. At the origin of the ductus endolymphaticus, unequal constriction takes place, forming the utricle. From the superior portion of the utricle spring the semicircular canals. The saccule, a much smaller pouch, takes its origin from the utriculus by a process of constriction. The constriction at the origin of the ductus endolymphaticus is sufficient to make this tube the only avenue of connection between the utricle and the saccule.

As remarked by Heisler, the beginning of the cochlear duct fails to keep pace with the other parts, and, in consequence, we have formed the canalis reuniens, the small canal connecting the sacculus with the ductus cochlearis. Were it not that certain cells of the otocyst have the faculty of growing into neuro-epithelium, known as sensory cells, the ear as a perceiving organ would be forever lost.

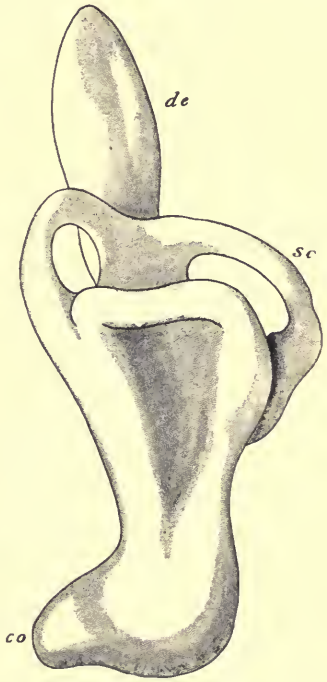

FIG. 2.—RECONSTRUCTION OF THE OTOCYST OF AN EMBRYO OF 13.5 MM. *co*, Cochlea; *de*, endolymphatic duct; *sc*, semicircular canal. (After *His, Jr., and McMurrich.*)

The organ of Corti, which is highly developed neuro-epithelium, extends the entire length of the scala media of the cochlea and becomes the great perceiving organ of the ear.

The macula acustica utriculi is a circular patch of specialized

neuro-epithelium, located on the lateral and anterior wall of the utricle.

The macula acustica sacculi is a continuation of the same form of neuro-epithelium as in the utriculi and organ of Corti and is located on the median surface of the recessus sacculi.

The ampullæ of the semicircular canals contain the cristæ acusticæ and resemble in neuro-epithelium, the utricle. The mucous lining of the membranous labyrinth is made up of flattened polyhedral cells and the neuro-epithelium takes on the form of modified columnar cells.

The auditory or acustic nerve takes its origin primarily from the acustico-facial ganglia, situated on the dorsum, or root, of the hind brain and is in close proximity to the otic vesicle.

The acustico-facial ganglia subdivides into the facial ganglia and the acustic ganglia. The facial ganglia extends itself and finally becomes the facial nerve. The acustic ganglia again subdivides and gives rise to two ganglia, one finally becoming the connecting link with the maculæ acusticæ and the other with the cristæ acusticæ. Thus the axis cylinder of the nerve is developed from the ectoderm and the enveloping portion from the mesoderm.

The fully developed membranous labyrinth (Fig. 3) is made up of semicircular canals, utriculus, sacculus, ductus endolymphaticus, canalis reuniens, ductus cochlearis, nerve structure and endolymph.

The bony portion of the internal ear springs from the mesodermic layer and completely surrounds the nerve structure. The accompanying illustration (Fig. 4) will give the reader a clear conception of how the internal ear is formed. Surrounding the otocyst or membranous labyrinth is a fibrous layer. Next to this is a gelatinous layer which successively dissolves or liquefies, becoming finally the perilymph. Beyond this layer is observed a fibrous layer again, which changes into perichondrium—finally into periosteum. Beyond this layer is a mass of periotic cartilage, which changes into osseous tissue of the temporal bone. With the exception of the cochlear region, the semicircular canal and the perilymph completely surround the otocyst. The formation of the cochlea is intensely interesting. In the early stage, according to Heisler and others, the epithelial

cochlear duct is short and tapering. After chondrification of the petrous bone, the duct lengthens and becomes spiral. The cochlear duct coils itself about a central axis or modiolus, which, before ossification, was composed of dense connective tissue, afterward changing

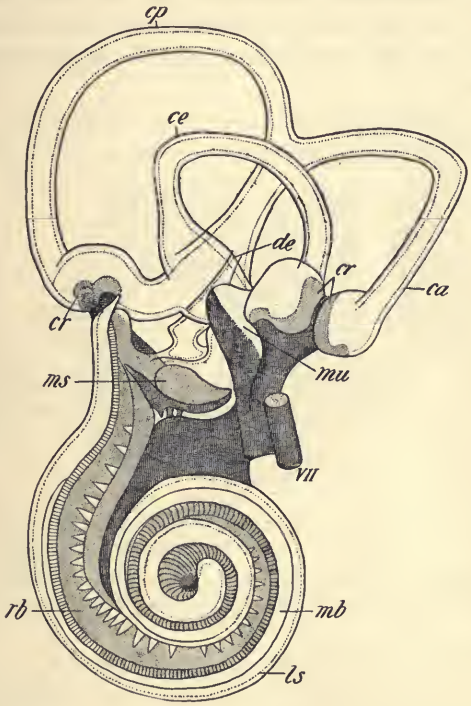

FIG. 3.—THE RIGHT INTERNAL EAR OF AN EMBRYO OF SIX MONTHS.

ca, *ce* and *cp*, Anterior, external and posterior semicircular canals; *cr*, crista acustica; *de*, endolymphatic duct; *ls*, spiral ligament; *mb*, basilar membrane; *ms* and *mu*, macula acustica sacculi and utriculi; *rb*, basilar branches of the cochlear nerve. (After *Retzius and McMurrich.*)

into cartilage and finally into bone. This portion of bone extends outward in a screw-shape from the modiolus, subdividing the cochlea into two parts at each spiral turn, which become the scala vestibuli and the scala tympani, and are lymph spaces containing perilymph.

The cochlear nerve contained within the modiolus, an extension of the auditory nerve, sends branches to the duct at each spiral turn of the cochlea enclosed within the scala media.

The scala vestibuli is subdivided by the membrana vestibularis. The base of the triangle is composed of fibrous connective tissue and extends from the two surfaces of the lamina spiralis ossea to the external wall of the cochlea, thus forming, with the membrana vestibularis, the scala media.

The scala vestibuli and scala tympani communicate at the apex of the cochlea. The scala tympani extends to the inner wall of the

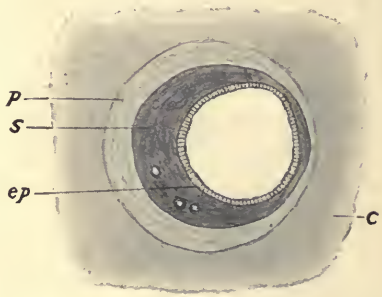

FIG. 4.—TRANSVERSE SECTION THROUGH A SEMICIRCULAR CANAL OF A RABBIT EMBRYO OF TWENTY-FOUR DAYS.

c, Periotic cartilage; *ep*, fibrous membrane beneath the epithelium of the canal; *p*, perichondrium; *s*, spongy tissue. (After *Von Kölliker and McMurrich.*)

middle ear filling the space surrounding the fenestra rotunda and the fenestra ovalis. The membranous semicircular canals are not surrounded by the perilymph but are attached directly to the surrounding bony wall.

Middle Ear.—The middle ear is composed of the tympanic cavity, mastoid cells and Eustachian tube and takes its origin from the endodermal layer of the first inner visceral furrow or branchial cleft. The inner visceral furrow, by a process of evagination of the primitive pharyngeal cavity, is prolonged upward, forming the tympanic cavity, while the tubo-tympanic sulcus connecting the middle ear with the pharyngeal cavity, grows together at its edges, forming the epithelial

lining of the Eustachian tube. Broadly speaking, surrounding the evaginated cavity, as in the internal ear, is the embryonal, mesodermic, connective tissue, which successively changes into cartilage and bone, becoming the "petrosa of the temporal bone."

The (Fig. 5) *malleus* and *incus* are formed by a constriction of embryonic cartilage of the first branchial arch, which partially forms the roof of the tympanic cavity. Upon ossification, the thin bones

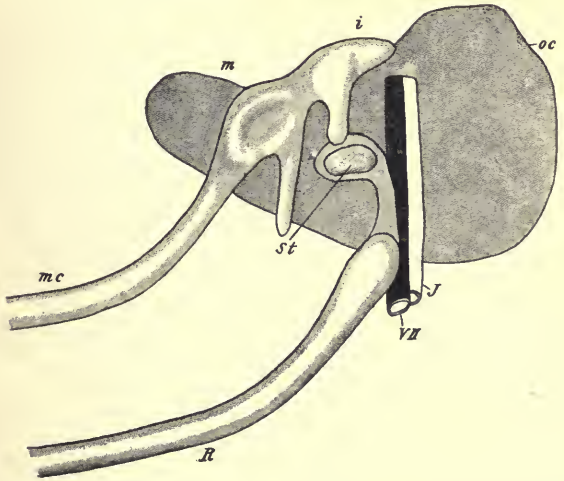

FIG. 5.—SEMI-DIAGRAMMATIC VIEW OF THE AUDITORY OSSICLES OF AN EMBRYO OF SIX WEEKS.

i, Incus; *J*, jugular vein; *m*, malleus; *mc*, Meckel's cartilage; *oc*, capsule of otocyst; *R*, cartilage of the second branchial arch; *st*, stapes; *VII*, facial nerve. (After *Siebenmann.*)

are separated, becoming respectively the malleus, incus and stapes, and with the development of the tympanic ring and petrosa, they are drawn into the natural position in the middle ear.

The stapes and stapedius muscles both take their origin from the second branchial arch. The first and second arches meet in primitive life about the tympanic cavity, forming the roof; within the spongy mesenchyme of the roof, the ossicles are imbedded. Near the end of fetal life, the mucous membrane wraps itself about the ossicles as a

result of spongification and absorption of the mesenchyme. The middle ear is fully developed at birth.

The *aditus ad antrum* and antrum are formed by evagination of the mucous membrane of the middle ear into the temporal bone. The

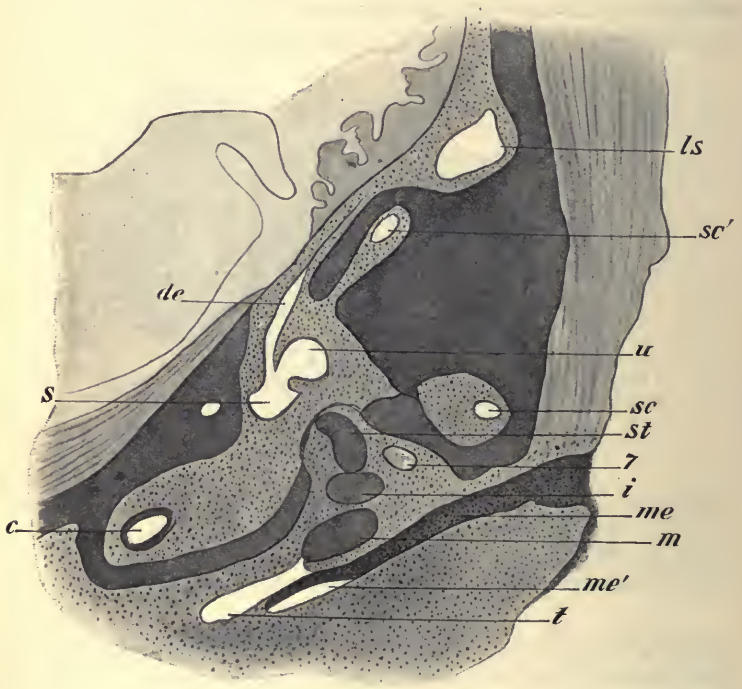

FIG. 6.—HORIZONTAL SECTION PASSING THROUGH THE DORSAL WALL OF THE EXTERNAL AUDITORY MEATUS IN AN EMBRYO OF 4.5 CM.

c, Cochlea; *de*, endolymphatic duct; *i*, incus; *ls*, lateral sinus; *m*, malleus; *me*, meatus auditorius externus; *me'*, cavity of the meatus; *s*, sacculus; *sc*, horizontal semicircular canal; *sc'*, posterior semicircular canal; *st*, stapes; *t*, tympanic cavity; *u*, utriculus; 7, facial nerve. (After *Siebenmann.*)

antrum differs from the other accessory sinuses in that it is fully formed at birth. Congenital absence of the mastoid antrum has been observed. The mastoid cells are formed after birth by a continuation

of the evagination of the mucous membrane of the middle ear and absorption of bone.

The membrana tympani and external ear are formed from the ectodermal groove of the first branchial cleft. Upon study of Fig. 6 the reader will notice the funnel-shaped, darkened area corresponding to the position of the external auditory canal. About the second month of fetal life, an ingrowth takes place, pushing itself inward

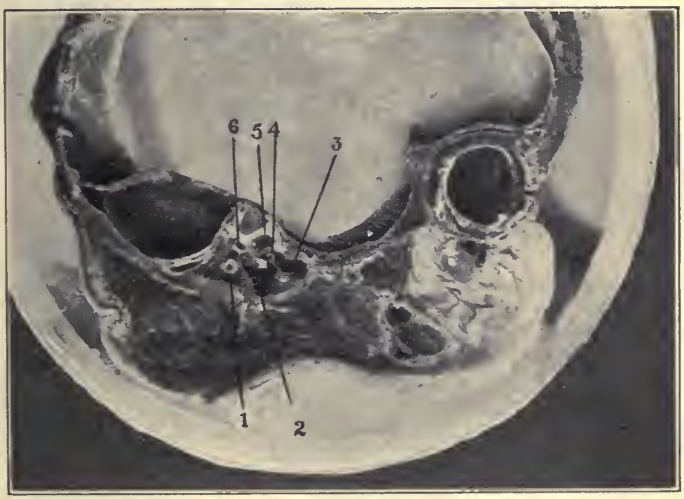

FIG. 7.—SAGITTAL SECTION OF HEAD OF FETUS AT EIGHTH MONTH.

1, Section of the posterior semicircular canal; 2, tympanic cavity; 3, membrana tympani; 4, stapes; 5, superior semicircular canal; 6, section of the common canal.

against the gelatinous mesoderm of the middle ear. This disk-like structure continues to develop until the seventh month of fetal life, when it is completely formed. The auditory canal is formed by a process of outward growth. The membrana tympani is, in consequence, covered with endodermal epithelium in the inner side and by ectodermal epithelium on the outer side.

External Ear.—The *auricle* or *pinna* takes its origin from six

little elevations of mesodermic tissue covered with ectoderm (Fig. 8) situated upon the posterior edge of the first and the anterior edge of the second arch, beginning about the fourth week of embryonic life and by a process of growth and differentiation of the layers of

FIG. 8.—STAGES IN THE DEVELOPMENT OF THE PINNA.

A, Embryo of 11 mm.; *B*, of 13.6 mm.; *C*, of 15 mm.; *D*, at the beginning of the third month; *E*, fetus of 8.5 cm.; *F*, fetus at term; 1, tragus; 2–3, helix; 4, antihelix; 5, antitragus; 6, lobule. (After *His and McMurrich.*)

each tubercle into cartilage and epithelium, we have formed the auricle or pinna.

Nose and Throat.—Situated on the oral fossa and appearing before the third week, are two plates, which are the beginning of the nasal fossæ. At about the twenty-eighth day, the plates become depressed from growth of tissue and become the nasal pits (Fig. 9).

Separating the two nasal pits are the two processus globularis, which are thickened growths of the nasal process (Fig. 9). The oral fossa is bounded laterally by the maxillary process, which unites with the globular processes (Fig. 10) and forms the nasal fossa. The nasal pits become canals connecting the two anterior nares with the primitive mouth cavity.

By gradual shrinkage, the broad nasal process becomes the septum

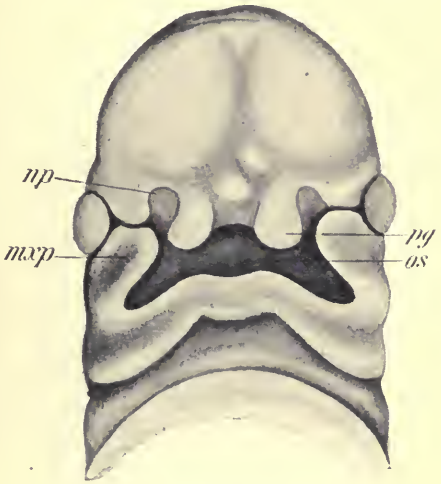

FIG. 9.—FACE OF EMBRYO OF 8 MM.

mxp, Maxillary process; *np*, nasal pit; *os*, oral fossa; *pg*, processus globularis. (After *His and McMurrich.*)

of the nose. The palate shelves gradually grow together at the median line separating the mouth from the nasal cavity.

The turbinated bodies are observed first as ridges on the lateral walls of the nasal pits. By a process of evagination of the ectodermic layer of the cavity, thin folds are formed. With each fold is a layer of mesodermic tissue, which changes into cartilage and subsequently into bone, becoming the thin turbinated bodies. By a continuation of evagination and absorption of tissue within the superior maxillary

growth of the alveolar process, the two antrums of Highmore are formed.

The maxillary sinus, or antrum of Highmore, is formed during fetal life by a process of evagination of the mucous membrane of the nose and absorption of bone within the superior maxillary bone. At birth, the antrum is a small slit in the maxillary bone. The growth

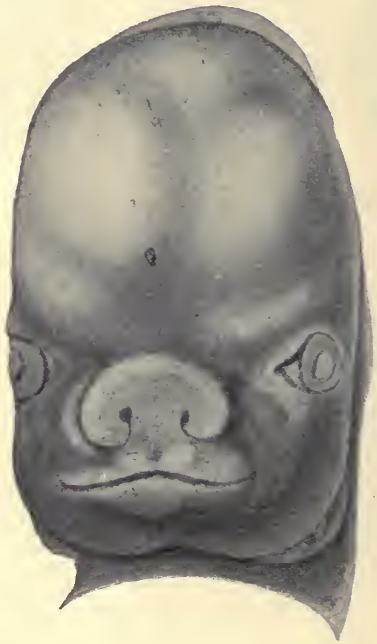

FIG. 10.—FACE OF EMBRYO AFTER THE COMPLETION OF THE UPPER JAW. (After *His and McMurrich.*)

of the maxillary sinus is contemporaneous with the growth of the maxillary bone, reaching its full development about the twentieth year of life.

By a process of evagination of the nasal mucosa after birth, absorption of spongy bone in the ethmoid and sphenoid bodies takes place, forming the ethmoid and sphenoid sinuses. The frontal cells form

by a like process of evagination and absorption of spongy portion in the frontal bone. The accessory cavities are lined with a pseudo-stratified ciliated epithelium of the same character as the respiratory region of the nose.

According to McMurrich, in the human embryos of the fourth week "the cells lining the upper part of the olfactory pits show a distinction into ordinary epithelial and sensory cells, the latter when fully formed being elongated cells prolonged peripherally into a short, narrow process which reaches the surface of the epithelium and proxi-

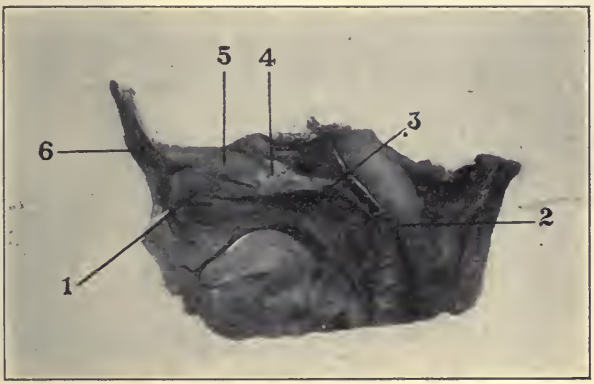

FIG. 11.—SAGITTAL SECTION OF EMBRYO OF THREE MONTHS.

1, Middle turbinated body; 2, pharyngeal wall; 3, pharyngeal opening of the Eustachian tube; 4 white discoloration showing the beginning of ossification in sphenoid bone; 5, cartilaginous ethmoid body; 6, compact frontal region.

mally gives rise to an axis-cylinder process which extends up toward and penetrates the tip of the olfactory lobe to come into contact with the dendrites of the first central neurons of the olfactory tract. These cells constitute a neuro-epithelium and in later stages of development retain, in the most part, their epithelial position. A few of them, however, withdraw into the subjacent mesenchyme and become bipolar, their peripheral prolongations ending freely among the cells of the olfactory epithelium. These bipolar cells resemble closely in form and relations, the cells of the embryonic posterior

root ganglia and thus form an interesting transition between these and the neuro-epithelial cells."

By a brief reference to Fig. 9, the mouth, which was before the third week the oral pit, is observed to be a five-sided fossa, bounded above by the naso-frontal process, laterally by the maxillary process and below by the mandibular arches. The palate is formed about the third month from a growth backward and toward the median line of the shelf-like portion of the upper jaw. A failure to unite

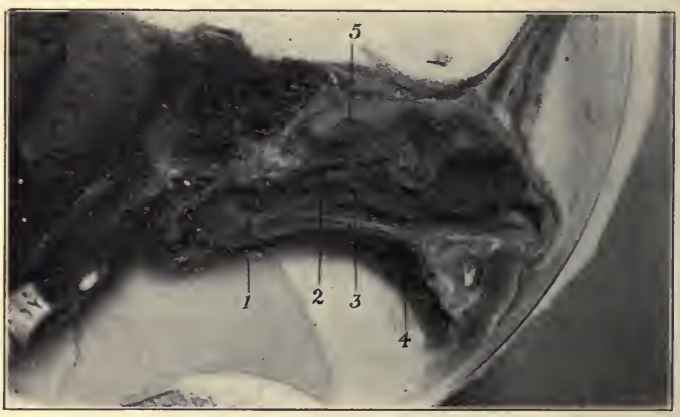

FIG. 12.—SAGITTAL SECTION OF THE HEAD AT EIGHTH MONTH.

1, Ostium tuba; 2, superior turbinated body; 3, middle turbinated body; 4, inferior turbinated body; 5, spongy bone forming the ethmoid body.

produces cleft palate. The uvula is formed by the union of the posterior edges of the soft palate which takes place near the end of the third month.

The tongue, essentially a muscular structure, is formed by a secondary growth forward from the pharynx. The anterior portion of the tongue develops from the tuberculum impar, situated in the anterior wall of the pharynx. The posterior and lateral segments of the tongue develop simultaneously with the tip from the second branchial arch, the line of union in the adult being the circumvallate papillæ. By the process of evagination and fusion of the three portions of the

embryonic tongue, a canal is formed, extending from the junction of the parts by a median line backward down to the middle of the thyroid body, and known as the thyro-glossal duct or canal of His. This fetal structure closes, as a rule, the remaining evidence being the foramen cecum of the adult. Sometimes, however, this canal remains and becomes manifest in adult life by the formation of a sac at the thyroid isthmus, or about the base of the tongue.

The pharynx in the embryo is the cephalic end of the primitive gut-tract. Within this region are the pharyngeal pouches or throat pouches in counter distinction to the outer visceral clefts. The tissue covering the pouches is made up of the ectoderm, which comes in contact with the endoderm and constitutes the closing membrane.

FIG. 13.—THE FLOOR OF THE PHARYNX OF AN EMBRYO OF 2.15 MM. *f*, Furcula; *t*, median portion of tongue. (After *His and McMurrich.*)

The Eustachian tube and middle ear are formed from the ectodermal groove of the first branchial cleft of the pharyngeal pouch by a process of growth outward and infolding of the walls of the first groove.

The second groove goes to make up at its lower portion the groove of Rosenmüller and the tonsillar fossa. The two lobes of the thyroid bodies are developed from the third groove.

The **pharyngeal tonsil** is made up of lymphatic tissue and is situated beneath the mucous membrane of the posterior wall of the pharynx, above the Eustachian tubes. It is presumably an histological structure disappearing about the twelfth year of life. Its development

after birth is dependent upon an inherited lymphoid diathesis and infection of the lymph patch from pathogenic organisms.

The **faucial tonsils** are lymphoid structures, found in the fetus as small budding epithelium, located upon the lateral wall of the pharynx and within the tonsillar fossa, containing blood vessels and undeveloped crypts. The follicles are formed at birth, by the evagination of the mucous membrane. The size of the tonsils depends upon the infection and infiltration of leucocytes, which cause the tonsils to take on a morbid growth and thus reach the varied sizes observed.

The Larynx.—A reference to Fig. 13 will show the larynx as it takes its origin from about the third branchial arch. Extending downward and laterally are the arytenoid ridges. With the development of the embryo, the arytenoid ridges separate by a vertical slit which finally become the vocal cords. The thyroid and arytenoid cartilages develop from two centers of chondrification and the cricoid from one. Fusion of the halves of the thyroid and the halves of the arytenoid with the complete formation of the larynx takes place about the fifth month of fetal life. The larynx becomes narrower in its transverse diameter after the infant begins to breathe, due to the drawing together of the aryteo-epiglottidean folds. (Turner, *Journal of Laryngology*, Vol. XXI, No. 10, 1906.)

CHAPTER II.

ANATOMY AND PHYSIOLOGY OF THE EAR.

The External Ear.—The external ear is composed of the auricle or pinna and the auditory canal or meatus auditorius externus. The auricle is a single cartilage composed of yellow, elastic, fibrous tissue, over which lies the perichondrium. Covering the perichondrium is the skin proper, containing sweat and sebaceous glands and a number of hairs. The muscles of the auricle are divided into extrinsic and intrinsic. The extrinsic are those at the side of the auricle and are the attolens, attrahens and retrahens aurem. The intrinsic are those within the boundary of the pinna and are the antitragicus, tragicus, helicus major and minor, transverse auriclæ and obliquus auris. The function of the pinna is the collection and conduction of sounds.

The cartilaginous elevation surrounding the pinna is called the *helix*. It terminates at the lobule, the most dependent part of the ear. The lobule consists of fat and areolar tissue. Within the helix and extending down to the antitragus, is the antihelix. In the superior and anterior portions of the antihelix, is a deep fossa, known as *fossa* of *antihelix*. Anterior to the antihelix and looking into the auditory meatus, is a deep cavity, called the *concha*. Anterior to the concha and projecting hood-like over the meatus is the *tragus*. Below the tragus and anterior to the antitragus, which is a small prominence on the antihelix, is a notch called incisura intertragica.

The auditory canal is composed of a cartilaginous and bony portion. The cartilaginous portion is an extension from the cartilage of the pinna. It is about one-half inch in length and varies in caliber. The bony portion is about three-quarters of an inch in length and terminates at the annula tympanica.

The skin covering the canal at the cartilaginous portion is an

extension from the pinna. The variety of epithelium varies slightly in character as it merges upon the osseous portion. Along the upper wall we find a great number of ceruminous glands, the function of

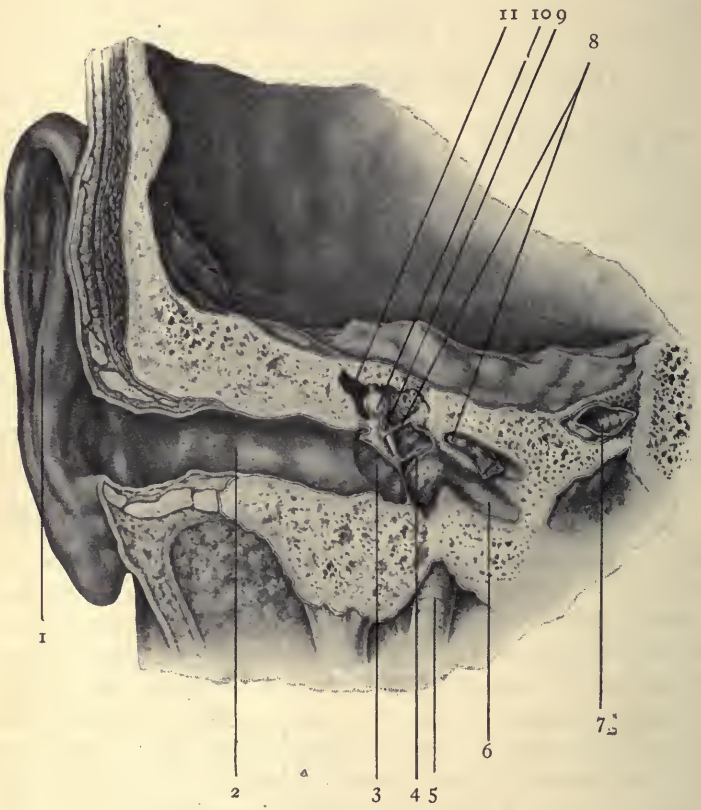

FIG. 14.—EXTERNAL AND MIDDLE EAR.

1, Pinna; 2, external auditory meatus; 3, membrana tympani; 4, stapes; 5, internal carotid a; 6, Eustachian tube; 7, internal carotid a; 8, tensor tympani; 9, incus; 10, malleus; 11, attic. (After *Deaver.*)

which is the secretion of a lubricating oil, called cerumen. These open into the duct beside the hair follicles. The meatus is thickly

studded with cilia, which, by a vibrating motion, aid in expelling glandular secretion and minute foreign particles, which may find entrance into the canal. As age increases, the cilia multiply and often grow to some length. The integument of the meatus is thin and is firmly attached to the underlying parts. The skin covering of the osseous portion of the canal is a continuation of that covering the cartilaginous portion, differing from the latter in that it contains neither glands nor hair. Slender papillæ are found in the vicinity of the tympanic membrane.

The *membrana tympani*, or drum-head, forms a part of the outer wall of the tympanum. It is composed of three layers: the external or cutaneous, the middle or lamina propria and the internal or mucous layer. The external layer is made up of stratified squamous epithelium and is formed by an extension of the cuticle of the external auditory canal. The layer is devoid of papillæ and detachable from the middle layer or lamina propria.

The strong middle layer is composed of two distinct, fibrous layers and external or converging fibrous lamellæ originating in the periosteum of the auditory canal and converging toward the center of the tympanic membrane. The inner layer is composed of fibrous bands which have a circular course and are more numerous at the external periphery of the membrana propria. In addition to the two distinct layers as enumerated, two sets of fibers are present, known respectively, as descending and arborescent fibers. The former radiate to the handle of the malleus from the superior segment of the tympanic membrane and later from the periphery.

The internal layer, which is in direct contact with the middle layer and inseparable, is composed of permanent epithelium and is a continuation of the mucous membrane of the middle ear. The character of the epithelium of the tympanic cavity changes at the *annulus fibrosus*. The drum is somewhat oval or elliptical in form, inclining downward and inward at an angle of about seventy-five degrees and ending peripherally in the shallow groove of the sulcus tympanicus.

The membrane is 10 mm. in length, 9 mm. in width and 0.1 mm. in thickness (Bruhl). The color of the drum viewed externally through the auditory canal is pearly gray. Three distinct landmarks

are visible: (1) The short process of the malleus; (2) the manubrium or long process of the malleus and umbo; (3) the light spot. The drum, or membrana tensa, may be subdivided into quarters or quadrants: two superior and two inferior quadrants. Above the superior quadrant and the short process of the malleus is situated the membrana flaccida, or Shrapnell's membrane. The tympanic membrane in this portion is composed of two layers only, the external or cuticular and the internal or mucous layers. A small foramen is supposed to exist in the membrana flaccida.

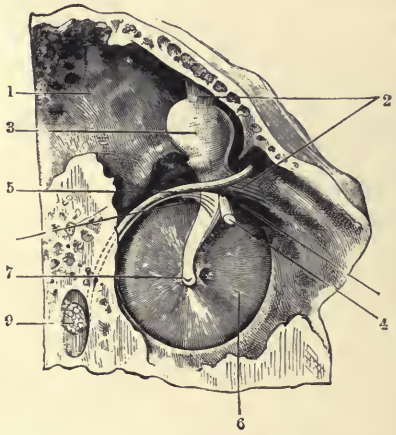

FIG. 15.—OUTER WALL OF THE TYMPANUM. (From *Heath's Anatomy.*)

1, Antrum; 2, ligaments of malleus; 3, head of malleus; 4, tendon of tensor tympani; 5, chorda tympani; 6, membrana tympani; 7, handle of malleus; 9, facial nerve in aqueductus Fallopii.

On the inner surface, the short and long processes of the malleus are found, fixed to the membrana propria. The long process may be seen extending backward and downward, ending near the center of the drum, from which is given off a triangular light spot, or cone of light extending downward and forward. The short process is more or less conspicuous, depending upon any pathological change in the drum or middle ear. The drum membrane, on account of its attachment to the malleus, is not evenly stretched. The function

of the drum membrane is the transmission of sound by vibration. These vibrations number from sixteen to forty thousand per second. The drum membrane is not essential to hearing.

The Temporal Bone.—The temporal bone is a large, irregular shaped bone, situated on either side of the skull, articulating in front with the great wing of the sphenoidal and frontal bones, above with the parietal and behind with the occipital bone. The apex of the pyramidal or petrous process articulates with the sphenoidal and occipital bones. The ossification of the temporal bone takes place from eight distinct points, one from the squamous, two from the styloid, one from the tympanic ring and four from the petrous. As a rule, the different parts are completely united at the fifth month of intra-uterine life. The points of junction are very vascular during the first year of life and, in consequence, inflammation may spread through the vascular structures with little resistance. (Macewen.)

The temporal bone is anatomically divided into three portions: (1) Squamous; (2) petrous; (3) tympanic. The squamous portion is a thin plate of bone, which when viewed laterally is circular in outline and extends downward posteriorly, joining the masto-squamosal suture, which may persist until puberty and in after life. The descending plates join the petrous portion internally at the petro-squamosal suture, which extends from a small notch behind to a similar notch at its lower anterior border and next the petrous bone. In children, this suture may remain unossified, thus permitting infection to be carried to the brain and meninges. The petro-squamosal sinus collecting veins from the tympanum, occupies the position of the petro-squamosal suture, emptying into the external jugular vein and disappears at full formation of the temporal bone. The petrous bone is a three-sided pyramid with its base in apposition with the base resting upon its squamous and mastoid bone and its apex in direct connection with the sphenoidal and occipital bone.

The *fossa subarcuta* is a fetal canal extending from the posterior surface of the petrous bone, between the superior petrosal sinus and the internal auditory canal, downward and winds under the semicircular canal to the outer surface of the bone behind the auricle. The external portion of the canal becomes obliterated at birth. Ac-

cording to Macewen, Gruber and Voltolini, infection may spread to the brain through this channel from the mastoid cells. The zygomatic process of the temporal bone has two origins, one anterior to the meatus auditorius and the other superior to the meatus. The supra-mastoid ridge is a prolongation of this root, and, as a rule, is situated a little below the floor of the middle fossa of the cranium. Below the supra-mastoid ridge and slightly above the back of the

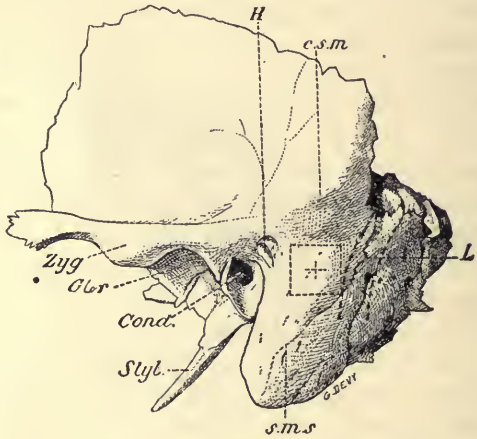

FIG. 16.—THE TEMPORAL BONE.

H, The spine of Henle; *c.s.m.* and *s.m.s.*, the two ridges, supra-mastoid and mastoido-squamous; *L*, the lateral sinus; *Cond.*, the bony meatus. (After *Broca*.)

meatus, is the spine of Henle. This important landmark is present, as a rule, upon examination of the temporal bone. The experience of a number of writers would lead us to depend upon the supra-mastoid fossa as a guide to opening the mastoid, rather than a literal dependence upon the small spine of Henle.

The junction of the squamous and petrous portions is called the squamo-mastoid suture. The mastoid process is situated posteriorly and inferiorly to the external auditory meatus. This is a structure (Fig. 16) of great importance to the student for herein is located the

antrum and mastoid cells. The structure of the mastoid process varies in childhood and old age. The external wall covering the mastoid antrum may, as in infants, be thin like tissue paper. In one adult subject, it may be of great density while in another it is of hard, thin bone. It will be observed that the pneumatic condition, which is usually found in the mastoid process of the adult, has a great tendency to disappear in the aged, which accounts for a loss of bone conduction. The depth of the antrum varies. *Broca*, who is freely quoted in the preparation of the anatomy of the ear, mentions the antrum in one case being situated 11 mm. from the surface, in another case

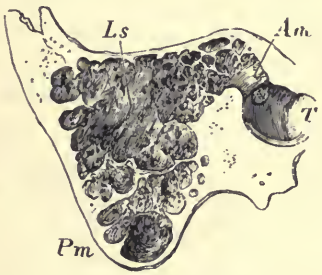

FIG. 17.—SECTION THROUGH THE MASTOID PORTION AND TYMPANUM OF A MAN AGED THIRTY. (After *Gruber and Hovell.*)

T, Tympanum; *Am*, mastoid antrum; *Pm*, mastoid process with *Ls*, pneumatic spaces.

15 to 16 mm. and in an extremely old case, 25 to 29 mm. No fixed rule can be found as an anatomical guide to the depth of the antrum. The usual depth of the antrum is from 12 mm. to 15 mm.

On the internal surface of the temporal bone is situated the petrous portion, presenting a three-sided pyramidal appearance. It supports and protects more organs of vital importance than any other portion of bone in the framework of the human body. The anterior border, assisted by the sphenoid bone, forms the foramen lacerum medius, the lower part of which is closed by fibro-cartilage, which is pierced by the vidian nerve, a meningeal branch of the ascending pharyngeal artery and an emissary vein. Into the upper part of the outer and anterior walls opens the canal for the carotid artery and vidian nerve.

The upper border presents a groove, which lodges the inferior petrosal sinus; the posterior border lodges the inferior petrosal sinus and jugular foramen (Bruhl). Through this foramen pass the glosso-pharyngeal, vagus and spinal accessory nerves, also the inferior and lateral sinuses, forming the internal jugular vein. The auditory nerve, artery, vein and facial nerve pass into the posterior and superior surface of the bone, through the internal auditory canal.

Near the middle of the pyramid on its superior border, anterior to the groove of the superior petrosal sinus, a bony ridge will be noted, which defines the position of the superior semicircular canal. External to the ridge is a depression beneath which is located the antrum and roof of the tympanic cavity. Through this thin plate of bone, pus frequently passes into the middle fossa, as a result of necrosis of the bone. The posterior wall, which separates the jugular fossa from the mastoid cells may also be thinned by suppuration, allowing the entrance of pus into the fossa or involving the outer covering of the cerebrum at its attachment to the posterior wall of the pyramid internal to the ridge of the jugular fossa. An abscess in this region can be opened and drained without injury to the lateral sinuses.

Facial Nerve.—At the bottom of the meatus auditorius internus the facial nerve enters the aqueductus Fallopii, cutting downward and outward, making its exit at the stylo-mastoid foramen. During the course of the facial nerve through the bony structure, two important branches are given off. The first is a small branch to the stapedius muscle, and the second is the chorda tympani, which passes through the canaliculus chordæ tympani and crosses the tympanic cavity anteriorly, passing between the long process of the incus and the inner surface of the malleus, thence passing through Huguier's canal, communicating with the otic ganglion, and passing on to join the lingual nerve.

The function of the branch to the stapedius is to supply that muscle with motor fibers. The function of the stapedius muscle is to lift the base of the stapedius out of the oval window. A paralysis of the nerve is followed by a decrease of hearing on that side, because of the stapedius being driven into the oval window by the tensor tympani muscle.

Certain fibers of the chorda tympani connecting with Arnold's ganglion send vaso-dilator fibers to the tongue, and also exercise an influence upon the sense of taste. Paralysis or injury of the chorda tympani, causes a loss of taste upon the anterior half of the tongue on the affected side. The motor fibers of the chorda tympani antagonize the stapedius and tend to hold the foot plate in the oval window.

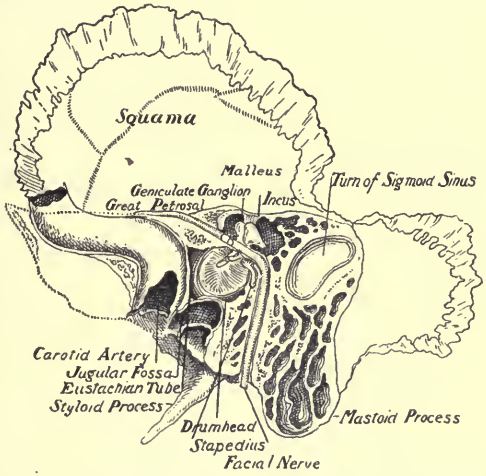

FIG. 18.—SAGITTAL SECTION OF TEMPORAL BONE, SHOWING COURSE OF THE FACIAL NERVE. (After *Randall.*)

After the nerve leaves the foramen stylo-mastoidium, the auriculous posterior is given off, which goes to the mastoid process and external ear, and communicates with the auricular branch of the pneumogastric. The auricular branch, or Arnold's nerve, takes its origin in the jugular fossa, passes to the inner side of the aqueductus Fallopii, to the back of the auricle. Two branches are given off, one to the posterior auricular branch of the facial, and the other to the back part of the external auditory canal and pinna.

Aural cough is produced by irritation transmitted to Arnold's nerve, which carries impressions to the fibers of the pneumogastric, supplying the larynx and trachea.

The position of the facial nerve in relation to the tympanic cavity is well shown in the illustration (Fig. 18). The position of the facial nerve, after its entrance into the internal auditory canal, becomes of special interest, on account of its frequent injury in tympanic and mastoid operations. The course of the nerve is across the inner wall of the tympanic cavity, and is observed lying in a bony eminence above the stapes, anterior to the horizontal semicircular canal, on a plane drawn through the neck of the malleus and the short process of the incus. A very thin partition, or wall, separates the nerve from the tympanic cavity. The wall is so thin that a sharp instrument will readily wound the facial nerve. In operating for abscess of the mastoid and the removal of necrotic bone in the tympanic cavity, by carefully avoiding this region, no danger of wounding the facial nerve is incurred.

The Middle Ear or Tympanum.—The middle ear, or tympanum, is a small irregular cavity, oblong in character, situated in the petrous

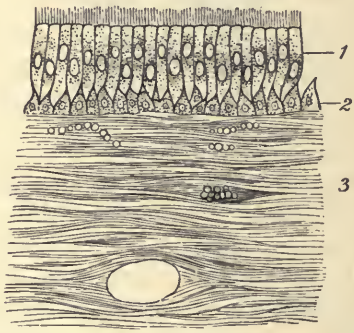

FIG. 19.—SECTION THROUGH THE MUCOUS MEMBRANE OF THE INNER WALL OF THE TYMPANUM OF AN ADULT. x 350. (*Schwalbe*, after *Brunner*.)

1, Ciliated epithelium; 2, basal cells; 3, connective tissue of the mucous membrane.

portion of the temporal bone, between the external meatus and internal ear. The mucous membrane of the middle ear is a simple pseudo-stratified ciliated epithelium, closely connected with the periosteum. Within this chamber are found the malleus, the incus and the stapes,

covered with the same variety of epithelium, with the exception of the ciliated variety, which is lacking to a great extent. The superior portion of the tympanum, beginning with a line drawn through the short process of the malleus, is the attic and has free communication with the mastoid antrum. The middle ear is of special importance on account of its peculiar structure and its relation to the mastoid cells. The attic lodges the greater portion of the ossicles. It is bounded externally by Shrapnell's membrane and by a bony wall, and superiorly, by the roof of the tympanum, which separates it from the middle cranial fossa. The posterior wall is important, for here is found the canal connecting the attic of the middle ear with the mastoid antrum, called the *aditus ad antrum.* The internal wall is in close apposition to the semicircular canal and the facial nerve. On the superior portion of the anterior wall is located the tympanic opening of the Eustachian tube.

"The ossicles are covered with a fold of mucous membrane which dips down between the ossicles and the chorda tympani nerve." Prussak's space is formed by such a fold and is located between Shrapnell's membrane and the neck of the malleus, above the lateral ligament. Small pouches of this character, situated in the attic, often communicate with each other. We may have suppuration from some portion of the attic emptying through the superior border of Shrapnell's membrane or pars ossa, without involvement of the tympanic cavity. Bruhl mentions the likelihood of pus draining from the upper incudo-malleolar space into the antrum or into Prussak's space through a perforation in Shrapnell's membrane, or into the tympanic cavity, followed by perforation lower down. It is for this reason that many cases of chronic suppuration, with perforation in the lower quadrant of the tympanic membrane, are slow to therapy. Piercing the tympanic cavity and especially the roof of the tympanic cavity, are lymphatics and veins through which infection may be carried to the brain cavity, causing abscess of the cerebrum or cerebellum, thrombus of the superior petrosal sinus, sigmoid sinus or meningitis.

The Blood Supply of the Middle Ear is from the tympanic branches of the internal maxillary and internal carotid arteries,

stylo-mastoid branches of the posterior auricular, the petrosal branch of the middle meningeal and a branch of the ascending pharyngeal artery, which passes up the Eustachian tube. The veins empty into the temporo-maxillary, superior petrosal, the lateral sinuses, the internal jugular vein and the pharyngeal sinus. Numerous small veins pass through the tegmen tympani, communicating with the veins of the dura mater (Deaver).

The Ossicles.—The ossicles are three in number, articulating in such a manner as to completely connect the membrana tympani with the fenestra ovalis. The stapes consist of a head, neck, two crura and a base. The cartilage-tipped head articulates with the long process of the incus. The two diverging crura connect the head with the base, which is attached to the oval window by a band of elastic fibers which have their origin in the periosteum of the surrounding bony structures. The incus is firmly supported in the fenestra between the malleus and stapes. It possesses two processes. The short process is attached lightly to the posterior tympanic wall. The long process continues backward, parallel to the malleus and articulates with the stapes by the intervention of the os orbiculare. The position of the incus and its attachments are of special interest, on account of the very frequent indication for the removal of this bone. The malleus is the larger of the ossicles. It connects the incus and membrana tympani, completing the ossicular chain. It possesses a head, neck and shaft and two processes, the long and short.

The articulating surfaces of the ossicles are covered with hyaline cartilage. The function of the ossicular chain is the transmission of sound waves. "This is effected by oscillation of the bone or molecular vibration of their particles, or probably both" (Kirke). Foster takes exception to the theory of molecular vibration, believing only in the oscillation of the small bones.

The stapedius and the tensor tympani are the two muscles of the middle ear.

The stapedius muscle takes its origin from the eminentia pyramidalis; its tendon passes into the tympanum through an aperture in the apex of the pyramid and is inserted at the head of the stapes. The nerve supply is from a branch of the facial nerve. The function of

the stapedius is to counteract the action of the tensor tympani muscle, preventing undue pressure of the stapes in the oval window, thus regulating the pressure against the endolymph and perilymph.

The tensor tympani muscle takes its origin in the posterior portion of the cartilaginous Eustachian tube, adjoining the surface of the

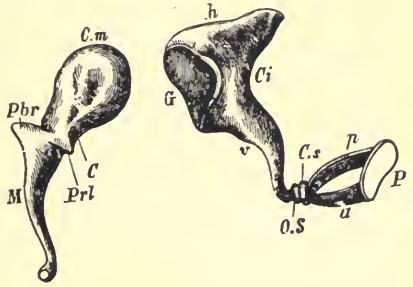

FIG. 20.—AUDITORY OSSICLES. (RIGHT.)

Cm, Head of malleus; *C*, neck; *Pbr*, short process; *Pbl*, long process; *M*, manubrium of handle; *Ci*, body of the incus; *G*, articular surface; *h*, short and *v*, long process; *O–S*, so-called lenticular ossicle; *Cs*, head of the stapes; *a*, anterior; *p*, posterior limb or crus; *P*, plate of the stapes. (After *Holden*.)

sphenoid bone and carotid canal and is located in a small, bony canal parallel to the Eustachian tube, it winds about the processus cochleariformis, passes into the tympanum and is inserted into the inner margin handle of the malleus. The function of the muscle is to increase the interlabyrinthian pressure by drawing the membrana tympani and ossicles inward and to equalize the retraction of the stapedius muscle. The nerve supply is from the otic ganglion.

According to Politzer, the two muscles "regulate the degree of tension of the hearing apparatus."

The Internal Ear.—The internal ear consists of an osseous and membranous portion, respectively, named the osseous and membranous labyrinths. The osseous portion relatively forms the inner wall of the tympanic cavity, and is fully developed at birth.

The membranous labyrinth is the same as the osseous in general outline. The structures are separated by a lymph space, filled with

perilymph, which is in direct communication with the subdural space of the brain by way of the sheath of the auditory nerve. As viewed in the figure (Fig. 21), the osseous portion possesses a vestibule, semicircular canals (three in number), distinct ampulla, fenestra rotunda, fenestra ovalis and bony cochlea. The osseous labyrinth is lined

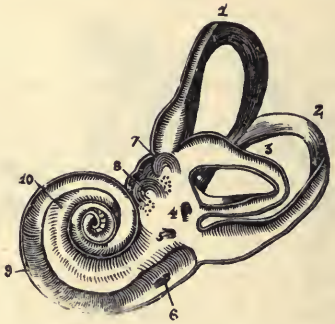

FIG. 21.—OSSEOUS LABYRINTH OF THE RIGHT SIDE.

1, The superior semicircular canal; 2, the posterior semicircular canal; 3, the external semicircular canal; 4, common opening of the superior and posterior semicircular canals; 5, aqueductus vestibuli; 6, aqueductus cochleæ; 7 fovea hemi-elliptica; 8, fovea hemi-spherica; 9, scala tympani; 10, scala-vestibuli. (After *Holden.*)

with a thin layer of periosteum covered with endothelial cells. In the normal condition the inner surface is smooth and compact. The membranous labyrinth contains the endolymph and (Fig. 22) is essentially the organ of perception, for herein terminates the auditory nerve, in a manner hereafter to be explained.

The membranous labyrinth differs from the osseous in this respect: in place of a vestibule, two sacs are present, the utriculus and the sacculus, connected by the utriculo-saccular duct. The saccule communicates with the cochlea by means of the canalis reuniens. The utriculus is continuous with the semicircular canal. Within the membranous labyrinth is found the endolymph, whose function is the transmission of vibration previously received from the perilymph, to the auditory epithelium of the cristæ and maculæ. The auditory nerve enters through the foramen auditorium internæ, and there it

subdivides. One branch passes to the ampulla of the semicircular canal and the utriculus, the other branch to the sacculus and the cochlea. It is supposed that the portion of the auditory nerve going to the semicircular canals, maculæ of the utricle and of the sacculæ plays a very important part in the control of the equilibrium of the

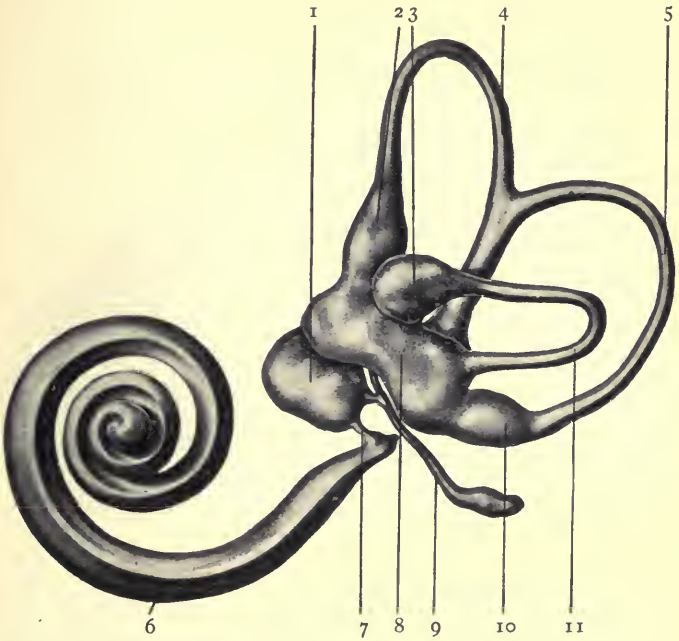

FIG. 22.—DIAGRAM OF MEMBRANOUS LABYRINTH.

1, Saccule; 2, ampullæ; 3, ampullæ; 4, superior semicircular canal; 5, posterior semicircular canal; 6, scala media of cochlea; 7, canalis reuniens; 8, utricle; 9, ductus endolymphaticus; 10, ampulla; 11, external semicircular canal. (After *Deaver.*)

body. "The portion of the nerve going to the cochlea carries auditory impulses only" (Foster).

Viewed transversely, the cochlea presents three distinct subdivisions: (1) Scala vestibuli, (2) scala tympani, and (3) canalis

cochlearis. The cochlear branch of the nerve passing upward through the lamina spiralis ossea distributes terminal fibers to the organ of Corti. The lamina spiralis ossa or *modiolus*, is a spiral, osseous structure with many perforations, extending from the base of the apex of the cochlea. From this median spiral canal, nerve filaments are given off to the spiral cochlear canal. The spiral cochlear canal

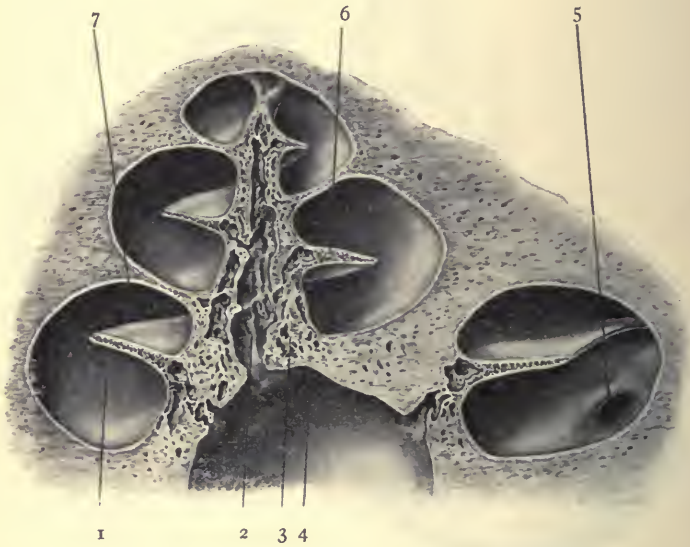

FIG. 23.—SECTION OF OSSEOUS PORTION OF COCHLEA.

1, Scala tympani; 2, central canal of the modiolus; 3, modiolus; 4, termination of internal auditory meatus; 5, aqueductus cochleæ; 6, lamina spiralis; 7, scala vestibuli. (After *Deaver*.)

is divided into two spaces by a bony and membranous septa, known respectively as the zona ossea and the zona membranacea or membrana basilaris, the latter connecting with the outer bony wall of the cochlea. Originating from the zona ossea and extending upward and outward, is a thin membrane known as Reissner's membrane or membrana vestibularis. The small, triangular space thus formed

by the membrane of Reissner and the membrana basilaris is known as the *ductus* cochlearis or *scala media* and contains the organ of Corti and endolymph. The organ of Corti is supported by the membrana basilaris.

Viewed in a cross section, the organ of Corti consists primarily

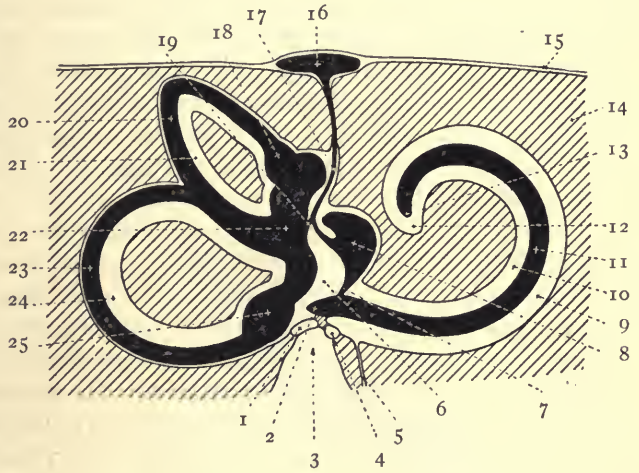

FIG. 24.—SCHEME OF THE RIGHT BONY AND MEMBRANOUS LABYRINTH. (After *Spalteholz.*)

1, Fenestra vestibuli; 2, cecum vestibulare; 3, cavum tympani; 4, fenestra cochlea; 5, ductus perilymphaticus; 6, spatium perilymphaticum of the vestibulum; 7, ductus reuniens (*Hensien*); 8, sacculus; 9, scala tympani; 10 scala vestibuli; 11, ductus cochlearis; 12, helicotrema; 13, cecum cupulare; 14, bone; 15, dura mater encephali; 16, saccus endolymphaticus; 17, ductus endolymphaticus; 18, ampulla membranacea superior; 19, ductus utriculosaccularis; 20, ductus semicircularis superior; 21, canalis semicircularis superior (spatium perilymphaticum); 22, utriculus; 23, ductus semicircularis posterior; 24, canalis semicircularis posterior (spatium perilymphaticum); 25, ampulla membranacea posterior.

of two sets of modified epithelial cells, the inner and outer rods of Corti, and rests on the basilar membrane. They unite above and form a membrane supporting, upon its inner and outer aspect, and under the arched membrane, epithelial cells possessing hair-like

processes, designated the inner and outer hair cells. Beneath the hair cells and extending upward and inward, are the cells of Deiter. Beyond the cells of Deiter are the supporting cells of Hensen. The membrana tectoria extends from the connective tissue thickening of the superior surface of the osseous lamina spiralis in a curved fashion to the last of the external hair cells. The cochlear nerve fibers as they leave the spiral ganglion are stripped of their medullary sheath and enter the organ of Corti as naked axis-cylinders and become the highly specialized sense organs, with the projecting hair cells of Corti as their termination. This is especially true of the inner hair cells.

The membranous semicircular canals are three in number and are the superior, posterior and anterior, all communicating with the utricle. These semicircular canals are made up of three distinct layers and are designated the external fibrinous layer, membranous layer and epithelial layer. The vestibular nerve, which arises from the ganglion of Scarpa situated in the auditory meatus, sends branches to the utricle and to the ampullæ of the three canals. The separate nerve fibers penetrate each ampulla, which point is designated the *crista acustica*. The point of distribution of the nerve in the utricle and the saccule is known as the *maculæ acustica*. The hair-like processes at the macula acustica, are covered with small crystals of calcium carbonate and are known as otoliths, the function of which is presumed to control the vibration of the hair cells.

Vibration of the endolymph influences the hair cells of the organ of Corti in such a way as to stimulate certain specific impulses, which are often very complex. These impulses range from sixteen to forty thousand vibrations to the second.

The Blood Supply.—The blood supply of the conducting apparatus is derived from the external and internal carotid. The auricle is supplied by branches of the occipital, the posterior auricular and a few small twigs from the temporal arteries. The internal maxillary artery gives off the tympanic and middle meningeal, which supply the greater amount of blood to the osseous portion of the external canal, the drum, the mastoid and the antrum. The superficial petrosal leaves the middle meningeal in the cranial cavity, turns downward through the petrous portion of the temporal bone and supplies

the malleus, stapes and incus, a branch supplying the floor of the tympanic cavity and the annulus tympanica. The veins empty into the external and internal jugular. The external jugular derives branches from the lobe and auditory canal. The internal jugular is of special interest on account of its close proximity to the tympanic cavity. Very often, as demonstrated by Dench, operations within this cavity may wound the jugular vein. The lymph supply is abundant within this region, anastomosing with those of the pharynx, mastoid, tympanum and external auditory canal. The arterial supply to the perceiving apparatus or internal ear is derived from the internal auditory, which is a branch of the basilar artery. It divides into two branches, the cochlear and the vestibular.

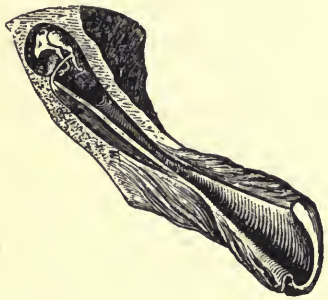

FIG. 25.—EUSTACHIAN TUBE.

As the cochlear branch enters the modiolus it subdivides at the first spiral turn of the cochlea into from twelve to fourteen twigs. These are successively given off to the lamina spiralis ossæ, thence to the substance of the lamina spiralis. The vestibulary branch accompanies the auditory nerve to the utriculus and sacculus, being distributed in the form of minute capillaries.

The Eustachian Tube.—The Eustachian tube (Fig. 25) is about one and two-fifths inches in length, extending from the tympanic cavity downward and inward through the petrous portion of the temporal bone to the naso-pharynx. The Eustachian tube is divided into an osseous and cartilaginous portion. The osseous portion is

about one-half inch long and the cartilaginous portion nearly one inch. The point of junction is called the isthmus of the tube, and is 2 mm. in diameter. The cartilaginous portion is funnel-shaped at its pharyngeal ending. The mucous membrane of the osseous portion is of the pseudo-stratified ciliated variety, pointing inward, containing no glands. The mucous membrane of the cartilaginous portion is likewise of the pseudo-stratified variety, much thicker than that found in the osseous portion and contains goblet cells and lymphoid tissue. At the pharyngeal orifice the blood supply is greater and the mucous glands are numerous.

The cartilage proper of the tube is shaped after the manner of the letter "S" reversed and forms the posterior wall, the upper border bending downward and forward. Fibrous and muscular tissue fill up the anterior space completing the canal. The mucous membrane, with the exception of the upper half of the tube, is in contact, forming irregular valves. The function of the Eustachian tube is to conduct air to the tympanic cavity and to act as a drainage canal for the middle ear. The muscles of the tube are abductor or dilator of the tube, spheno-salpingo-staphylinus (tensor-palati mollis) and the levator veli palati. The salpingo-pharyngeus is a thin muscular layer, classed by some as fascia, connecting the posterior pharyngeal end of the cartilage with the posterior wall of the pharynx. The abductor muscle arises from the inferior surface of the sphenoidal bone, pterygoid process and the cartilage of the tube. It passes downward attaching itself along the convex border of the outer cartilage along its entire length, ending in the soft palate and side of the pharynx. The function of the muscle is to assist in opening the tube. The levator veli palati originates on the lower surface of the petrous portion of the temporal bone, at the border of the entrance of the carotid canal. It is attached to and parallel with the floor of the membranous portion of the canal and ends in the soft palate. Its function is to assist in shortening and widening the tube.

Lymphatics.—The deep cervical chain (Fig. 26) is the great conducting lymphatic of the external ear, mastoid glands and auditory canal. The position of the chain of glands is beneath the sterno-mastoid muscle and in the subclavian triangle.

Conducting vessels empty into this system, according to Poirier, Cuneo and Delamere, from the tongue, part of the naso-pharynx, all the lymphatics of the middle and inferior portion of the larynx, the vault of the palate and soft palate, nasal fossæ and cervical portion of the trachea.

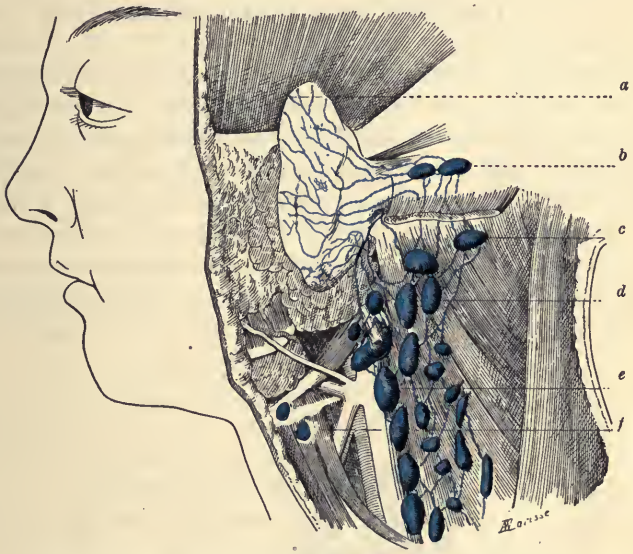

FIG. 26.—LYMPHATICS OF THE VESTIBULE OF THE AURICLE (INTERNAL SURFACE).

a, Collecting trunks of the auricle; *b*, mastoid glands; *c*, sterno-mastoid gland (external group); *d*, gland of the external jugular chain; *e*, sterno-mastoid gland (internal group, internal jugular chain); *f*, sub-hyoid aberrant gland placed in the course of the efferent vessels of the submental glands. (After *Poirier, Cuneo and Delamere.*)

By a study of the illustration, we can understand how in infection of the organs enumerated we have enlargement of the lymphatic glands of the neck. Some of the lymphatics of the tympanic cavity and Eustachian tube empty into the retro-pharyngeal glands.

CHAPTER III.

THE NOSE AND NASAL FOSSÆ.

THE nose is the beginning of the respiratory tract and is situated in the median line of the middle third of the face. Two subdivisions are at once apparent, viz.: anterior nares and nasal fossa. It possesses two parallel chambers, opening anteriorly to the nostrils and communicating posteriorly with the naso-pharynx. The lateral surfaces of the external nose are triangular, although it will be observed that racial characteristics play a conspicuous part is moulding the shape of the nose. At the root of the nose or at the joint of articulation

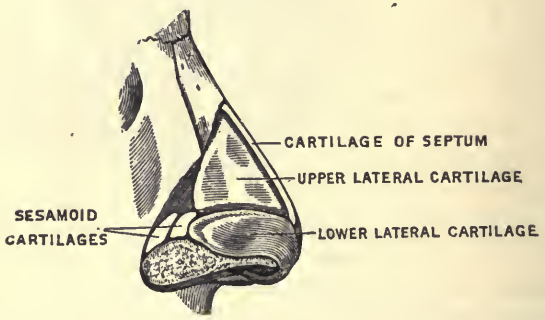

FIG. 27.

with the frontal bones are the two nasal bones and the two nasal processes of the superior maxillary bones. Below and outward on the lateral surfaces are situated the upper and lower lateral cartilages. Posterior to the lower lateral cartilages are the sesamoid cartilages, below which are situated the cell tissues, covered externally with normal skin. The nerve supply is from the nasal infra-trochlear and infra-orbital nerves, with branches from the facial nerve. Seba-

ceous glands are freely distributed over the surface. The base of the nose presents two apertures separated by the septum, extending antero-posteriorly. The septum is formed by the perpendicular plate of the ethmoid bone, the vomer and an anterior cartilage, hyaline in character. The attic, or roof, is formed by the horizontal plate of the ethmoid, nasal bone and nasal spine of the frontal bone. The posterior portion of the roof is formed by the anterior wall of the sphenoidal cells. The outer wall is formed by the frontal, ethmoid, lachrymal and sphenoid bones. Three distinct scroll-shaped irregularities are observed on the outer walls of the nasal fossa, the superior, inferior and middle turbinated bones (conchæ nasi) (Fig. 28). Sometimes above and behind the superior turbinated body, remnants of a fourth turbinated body may be found. This usually exists in fetal and early infantile life, but soon disappears by process of growth and absorption.

The superior turbinated bone is situated far back in the nasal attic chamber, and is from 5 to 6 mm. in length. The meatus of the superior turbinated body is closed in front, opening backward into the spheno-ethmoidal recess. The middle turbinated body is somewhat lower down and extends further forward. Its length varies from 30 to 40 mm. The meatus is open its entire length and on account of the numerous ostea opening into it, becomes an important structure in nasal diseases. The lower turbinated body extends practically three-fourths of the length of the outer wall of the nasal fossa and is 40 to 50 mm. long and 12 to 15 mm. wide at its widest part. The meatus extends backward and downward. It receives the secretions from the lachrymal gland and duct. Its connection with the floor of the nose makes it an important drainage canal of the nose. The first two turbinated bodies are extensions of the ethmoid bone. The lower turbinated bone is a distinct bone, articulating with the superior maxillary, and varying in length from 20 to 50 mm. The recesses below the turbinated bones are correspondingly called superior, middle and inferior meatuses.

The *uncinate process* (see Fig. 31) is a narrow cleft or ledge situated on the outer wall of the nasal fossa and below the attachment of the middle turbinated body. It takes its origin at the outer ethmoid

cells and extends downward and backward beyond the maxillary ostium.

The *hiatus semilunaris* is from 15 to 20 mm. long and 2 to 4 mm. wide and is situated in the middle meatus between the uncinate process and the bulla ethmoidalis (see page 3). Into this cleft glides the infundibulum anteriorly. The cleft is deepest in front and gradually fades away after leaving the ostium maxillare. The function of the groove is to receive any discharge from the frontal, anterior ethmoid cells and the antrum of Highmore.

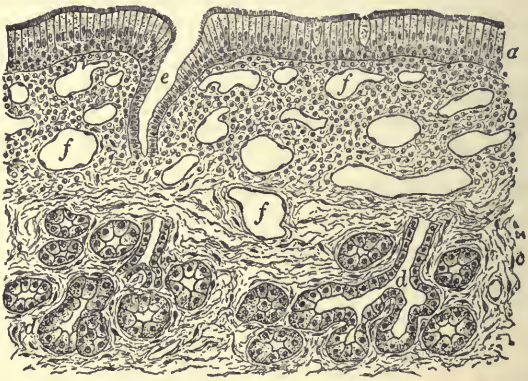

FIG. 28.—SECTION THROUGH MUCOUS MEMBRANE OF RESPIRATORY REGION OF CHILD'S NOSE.

a, Ciliated epithelium; *b*, tunica propria; *c*, submucous connective tissue; *d*, mucous glands; *e*, duct of glands opening on free surface; *f*, blood vessels. (After *Piersol.*)

The *bulla ethmoidalis* is situated in the meatus semilunaris and above the uncinate process and is part of the middle ethmoidal cells. It is a small, round, bony prominence, with the convexity downward and forward, containing one or more cells which open on its superior surface into the middle meatus.

The nasal cavity is divided regionally into the vestibular, respiratory and olfactory regions and the accessory cavities.

Beginning with the vestibule, which is that part of the nose opening anteriorly, is the Schneiderian or pituitary membrane, otherwise

known as the mucous membrane, which is continuous with the accessory sinus and Eustachian tube. The vestibular region is covered with stratified pavement epithelium, which contains sweat and sebaceous glands and numerous hairs or vibrissæ, which guard the entrance. Slightly below the entrance, the glands and hairs gradually disappear and the mucous glands appear. The respiratory region begins, relatively speaking, at the anterior end of the lower turbinated bone, extending upward as far as the edge of the superior turbinate. The epithelium changes at the inner margin of the vestibule to the pseudo-stratified ciliated variety containing goblet cells. The tissue covering the surface of the lower turbinated bone is irregular in outline and contains cavernous spaces of erectile tissue. The mucous, serous and lymphatic glands are present in great numbers. The mucous membrane is, in consequence, much thicker and more vascular than that of the olfactory region. The mucosa of the middle turbinated bone gradually changes in density from its lower border upward and contains a lessened amount of blood supply and cavernous tissue.

The olfactory region is that portion of the nasal fossa above the dependent portion of the superior turbinated bones. The epithelium covering this region, both septal and turbinal, is made up of a single layer of cylindrical cells, the nuclei of which lie at different levels (Szymonowitz and McCallum) and differs distinctly in color from that observed in the respiratory region, being of a yellowish tinge rather than of a pale pink. The mucosa is thin and, to a certain extent, non-vascular.

According to John A. Fordice, "the mucous lining of the oral and nasal cavities and the conjunctiva is developed from the ectoderm and is therefore not a true mucous membrane but resembles in structure the skin rather than the true mucosa of the deeper digestive tract which takes its origin from the endoderm. The diseases of the oral and nasal cavities are, therefore, logically related to those of the skin, because of the common embryological origin of the respective tissues. The outer layer of the epidermic covering of the mouth, which consists of stratified squamous cells and is continuous with that of the skin and pharynx, is kept constantly moist by the mucous and salivary secretions. The cells, unlike the statified horny layer of

skin exposed to the atmosphere, do not lose their nuclei as the surface is approached. On the lips, where the skin passes into the mucous membrane, the epidermis becomes greatly thickened, while the connective tissue grows thinner. The hair follicles disappear but the

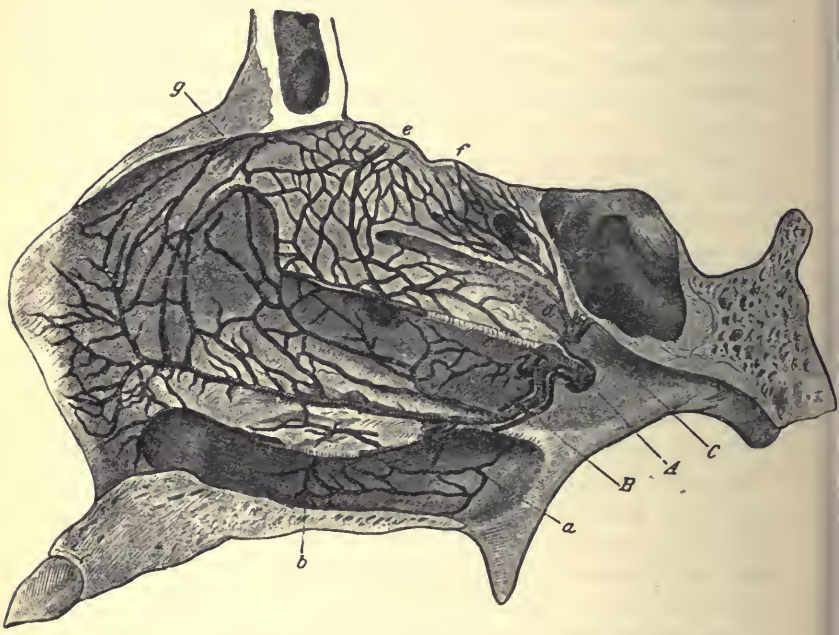

FIG. 29.—THE LATERAL WALL OF THE RIGHT NASAL CAVITY, SHOWING THE ARTERIES. (After *Zuckerkandl and Lamb.*)

A, Posterior nasal artery; *cc*, branch to the middle turbinal; *a–b*, branches to the lower meatus; *B*, main trunk dividing at the posterior end of the lower turbinal into three branches, for the supply of that body and the adjoining parts of the middle meatus; *C*, naso-palatine artery, giving off branches to the superior turbinals; *e–g*, branches of the anterior ethmoidal artery; *f*, anastomosis with posterior ethmoidal artery—the venæ comites of the posterior nasal artery are shown passing through the spheno-palatine foramen with that vessel.

sebaceous glands persist near the angle of the mouth and in the upper lip."

The Olfactory Nerves.—The olfactory nerves enter the nasal fossa through the cribriform plate of the ethmoid bone by twelve

or more branches from the olfactory bulb. They are subdivided into three portions, the inner, middle and outer. The inner portion is distributed to the septum at its upper third, the middle portion to the roof of the nose, and the outer to the surface of the superior and middle turbinated bone and the anterior surface of the ethmoid bone in front of them (Gray).

Within the epithelium of this region are the olfactory and sustentacular cells, which receive the sensory impulses, known as smell. According to Dienlofe, olfaction is more acute in women than in men, and in girls than in boys.

The glands of Bowman supply the mucosa with a serous secretion which keeps the surface moist and in a condition to receive atmospheric impressions. It will be noticed that a drying up of the secretions from atrophy of the small glands or obstruction of the lumen of the ducts from active or passive hyperemia, is a potent cause of anosmia.

The Nasal Nerve.—The nasal nerve, which is a branch of the ophthalmic division of the fifth nerve, passes into the nasal fossa through the slit at the side of the crista galli, thence downward and forward, supplying the sensation to the tip of the nose and to the outer surface of the anterior nares and septum. Branches from the anterior palatine are distributed to the inferior turbinated bone and its meatus. The superior nasal nerve supplies the middle and superior turbinated bone, the posterior part of the septum and the posterior ethmoidal cells. The naso-palatine, a branch of the Meckel's ganglion, supplies the middle portion of the septum. The vidian nerve unites with those from Meckel's ganglion. These nerves are part of the sympathetic system. The spheno-palatine of the sympathetic (Meckel's ganglion) sends branches to the upper, middle and lower turbinated bones and to the posterior portion of the septum. The anterior palatine nerve extends itself forward upon the middle ear and inferior turbinated body. The fibers control the vascular and secretory system of the nasal fossa. The antero-superior dental branch of the superior maxillary nerve supplies the inferior turbinated bodies and the inferior meatus.

The *blood supply* of the nasal fossa is from the spheno-palatine artery, a branch of the internal maxillary. Two branches are given

off from the spheno-palatine, the internal going to the septum and the external to the lateral walls, ethmoid cells, frontal sinus and antrum of Highmore. The anterior and posterior ethmoid arteries, subdivisions of the ophthalmic, supply short branches to the attic, ethmoid cells and frontal sinuses. The superior coronary sends short branches to the anterior portion of the septum. The descend-

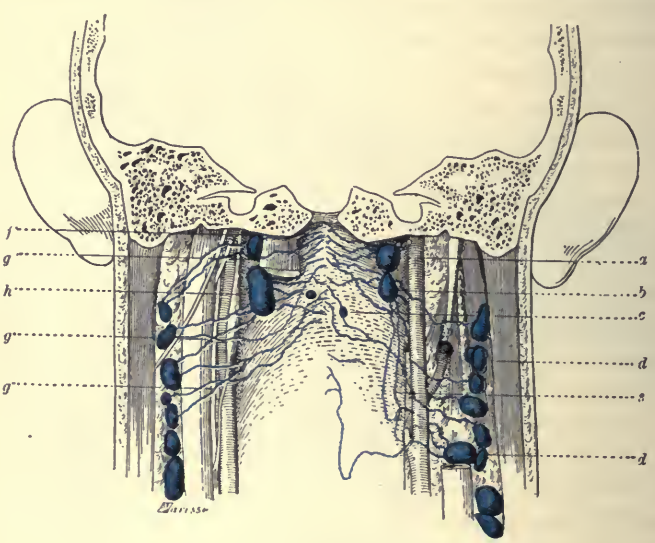

FIG. 30.—RETRO-PHARYNGEAL GLANDS.

a–b, Retro-pharyngeal glands; *c*, interrupting glandular nodule, placed in the course of the afferent vessels of these glands; *d*, gland of the deep cervical chain; *e*, efferent vessel of retro-pharyngeal glands, passing in front of the internal carotid artery; *f*, afferent of the retro-pharyngeal glands passing behind the right rectus capitis anticus major; *g*, lymphatic of the pharynx, passing directly to a gland of the deep cervical chain; *h*, afferent of the retro-pharyngeal gland. (After *Poirier, Cuneo and Delamere.*)

ing palatine, which is a branch of the internal maxillary, sends branches to the posterior region of the outer wall.

The veins of the nasal cavity form a plexus beneath the mucous membrane, emptying into the pharyngeal plexus, ophthalmic vein, facial vein, veins emptying into the superior longitudinal sinus and the intra-cranial vein.

The **lymphatics** are very numerous. They cover the surface, forming a continuous network. They are more numerous over the posterior part of the middle turbinated body. There are two connecting trunks, anterior and posterior. The anterior trunk, according to Poirier, Cuneo and Delamere, terminates in the submaxillary glands. The posterior trunk "constitutes the principal lymphatic channel of the nasal fossæ. They take their origin at the junction of the nose and naso-pharynx and empty into the retro-pharyngeal glands. A detailed study of the lymphatic system is necessary to a thorough appreciation of the constant absorption into the lymphatic system of diseased products from the nasal cavity and their influence upon the health of the individual."

Function of the Nose.—The functions of the *nasal* cavity as described by Burnett, are (1) respiration, (2) olfaction, (3) resonation of the voice, and (4) regulation of the atmospheric pressure in the middle ear.

The air, as it passes through the nasal cavity, is warmed, moistened and purified and is thus prepared for reception into the lungs. Moisture is furnished from the mucous surface; heat is generated by the muscular activity of the body; the air is purified by the long hair of the vestibule, which acts as a sieve. Abnormal atmospheric pressure upon the mucosa of the nose and naso-pharynx, will disturb its molecular equilibrium and quickly affect nutrition of the Eustachian tube and pneumatic function of the middle ear. The reflex action of sneezing and a slight bactericidal property of the nasal secretion, aid in preparing the air passage into the lungs. The sense of smell, in enabling us to avoid noxious air, also aids greatly in respiration. Since inspired air demands such radical alteration before entering the lungs, it is at once apparent why mouth-breathing is so detrimental to health. We can also conclude how quickly an alteration in the size of one or the other of the nasal cavities, sufficient to prevent the air from reaching the greatest possible surface of the cavity, may also contribute to a disease of the upper and lower air passages. The respiratory region of the nose is not a fixed one and depends upon the shape and size of the nostrils.

Many experimenters believe that the respiratory current passes

above the lower turbinated bone, even to the olfactory region, rather than below the turbinated bone, as is so often described.

The quality or timbre of the voice depends greatly upon the character of the nose and accessory cavities. Any interference with the sound waves, in their passage through the nose, destroys the natural resonance of the voice. To a great measure, the size of the accessory cavities affects the quality of the voice.

The olfactory sensibility is necessarily dependent upon the normal condition of the mucosa for atmospheric waves to produce their impression upon the hair cells of olfaction. The sense of smell is dependent upon the olfactory nerve with its filamentous distribution over the mucosa lining the upper part of the septum, the attic, the superior and middle turbinated bodies.

Olfaction is dependent not alone upon a normal condition of the nerve but upon the bony structure of the ethmoid bone or cribriform plates of the ethmoid and mucous membrane through which it must pass to reach the periphery. Congenital and acquired deformities of the intra-nasal structure frequently interfere with the function of the olfactory nerve. Suppurative inflammation of the accessory sinuses and nasal cavity may involve the mucous membrane surrounding the auditory filaments, partially destroying the hair cells of the olfaction.

Within the vestibule of the nose are a number of short hairs or *vibrissæ*, the function of which is to act as a filter for the inspired air. Within the region are found sebaceous glands emptying into the hair follicles and at the level of the cartilage, mucous glands. The function of the glandular secretion is to moisten the surface and lubricate the cilia.

Within the *tunica propria* of the olfactory region of the nose, are situated Bowman's glands, which are tubular glands lined with round pigmented epithelium, secreting mucus.

They sometimes extend into the respiratory epithelium of the nose.

Within the respiratory mucous membrane of the nasal cavity are situated the muciparous glands, the function of which is to lubricate the surface of the mucous membrane and ciliated epithelium, furnish moisture to the inhaled air and act as a solvent medium for dust.

The nasal secretions are slightly antiseptic, exercising a mild germicidal influence upon bacteria, which are constantly present in the nasal cavity.

Normal respiration is through the nose. Warmth is generated sufficiently to bring the inspired air up to "blood heat" during its passage through the nose.

CHAPTER IV.

ACCESSORY SINUSES.

The accessory sinuses of the nose are those cavities or pneumatic air spaces which are in direct relation, by one or more openings, with the nasal cavity. They consist of two frontal, two ethmoidal and two sphenoidal sinuses, with two antra of Highmore (sinus maxillaris). The mucous membrane covering the sinuses is of a pseudo-stratified ciliated variety and pale pink in color. The mucous membrane lining the cells is in direct apposition to the bone, varying in thickness in the different sinuses. The mucous glands of the epithelium are of the simple tubular variety.

The function of the accessory sinuses is principally to lighten the weight of the skull and to contribute an uncertain influence to the resonance of the voice. As the mucous surface is supplied with glands and a plexus of blood vessels, a certain amount of mucus is furnished to the surface of the nasal cavity and contributes moisture to the inspired atmosphere. The theory of Halle, of Berlin, is that the air passing in and out of the nose sucks out the air and secretion within the sinuses.

In making a lateral section of the adult skull, as shown in the accompanying illustration (Fig. 31), the frontal sinuses are first presented for observation. At the end of the first year the two halves of the frontal bone unite at the frontal suture. About this time the frontal sinuses begin to develop. The general opinion is that these sinuses are not formed until after the eighth or tenth year. (See Embryology of Nose.)

The frontal cells are normally two in number, though exceptionally, they may be entirely absent or consist of only one cell, varying in size. The two normal cells are separated by a thin mesial septum. There is seldom any connection between the two cells. Occasionally one

or more perforations are observed in the thin septum. Perforations of this character and faulty development are in accordance to a law of embryological development. In the Caucasian the cells are more developed in men than in women. The marked irregularity of the cells can be shown by Wood's metal cast, which is made by melting

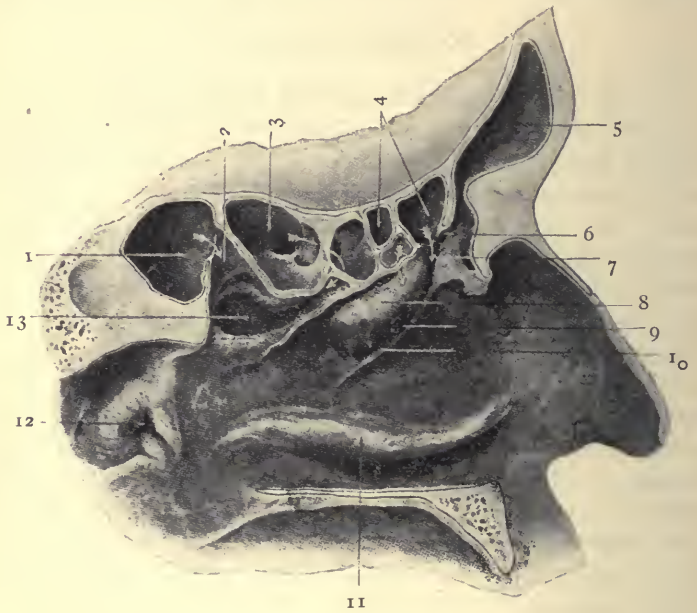

FIG. 31.—1, Sinus sphenoidalis; 2, recessus spheno-ethmoidis; 3, cellulæ ethmoidalis posterius; 4, cellulæ ethmoidalis anterius; 5, sinus frontalis; 6, ductus naso-frontalis; 7, infundibulum; 8, bulla ethmoidalis; 9, hiatus semilunaris; 10, processus uncinatus; 11, concha inferius; 12, tuba Eustachius; 13, meatus superius. (After *Turner*.)

a preparation of lead and pouring it into the sinuses through a small opening at the superior extension of the sinuses, the naso-frontal duct being primarily closed. The bone is afterward exposed to a solution of caustic potash and after having softened, is dissected from the cast. The same process may be carried out in securing casts of other sinuses or of the middle or internal ear.

Two surfaces of the frontal bone are presented, the outer and the inner. On the outer surface, above the roof of the nose, in a median line, is situated the glabella. To the right and left of and below the frontal eminences, are situated the superciliary ridges. Their convexity at the junction of the glabella is often very great. This con-

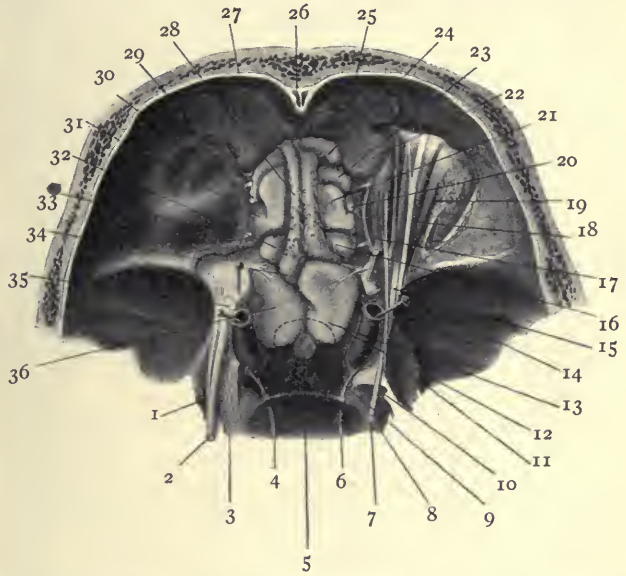

FIG. 32.—THE RELATION OF THE ACCESSORY SINUSES TO THE BASE OF THE SKULL, VIEWED FROM THE CRANIAL CAVITY. (After *Killian.*)

1, Trochlear nerve; 2, oculo-motor nerve; 3, trigeminal nerve; 4, abducens nerve; 5, sella turcica; 6, abducens nerve; 7, oculo-motor nerve; 8, trigeminal nerve; 9, region of hypophysis cerebri; 10, trochlear nerve; 11, trochlear nerve; 12, cavernous sinus; 13, right sphenoidal sinus; 14, frontal nerve (trigen.); 15, oculo-motor nerve; 16, cell of highest meatus; 17, superior oblique; 18, levator palpebræ superioris; 19, superior rectus; 20, upper intermediate cell of middle meatus; 21, ascending cell of superior meatus; 22, orbital recess of frontal sinus; 23, fourth frontal cell; 24, second frontal cell; 25, frontal sinus (third frontal cell); 26, superior longitudinal sinus; 27, frontal sinus (third frontal cell); 28, olfactory fissure; 29, anterior ethmoidal vessels and nerves; 30, upper intermediate cell of middle meatus (cell of ethmoidal bulla); 31, ascending cell of superior meatus; 32, cell of highest meatus; 33, posterior ethmoidal vessels; 34, spheno-ethmoidal recess; 35, optic nerve; 36, left sphenoidal sinus.

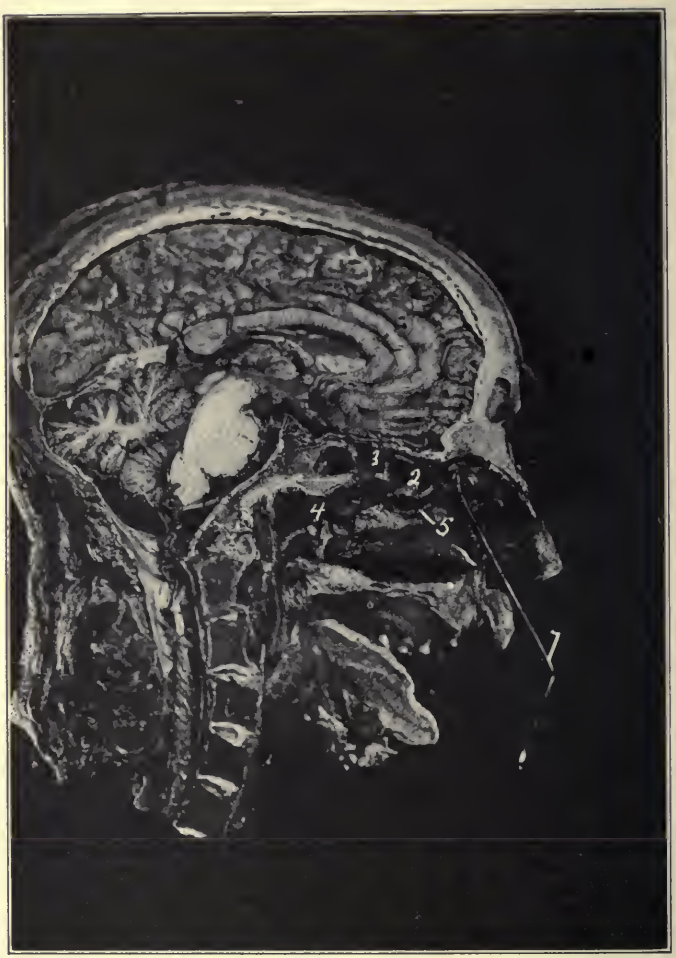

FIG. 33.—SAGITTAL SECTION OF THE HEAD SHOWING MIDDLE AND SUPERIOR TURBINALS REMOVED.

1, Freeman's frontal bougie in the naso-frontal duct; 2, anterior and middle ethmoid cells exposed; 3, posterior ethmoid cell exposed; 4, vault of the pharynx; 5, ostium maxillare.

vexity gradually fades away as they arch upward. The comparative size of the convexity of the glabella and of the superciliary ridges is an indication of the size of the frontal cells, which are situated immediately beneath them. The cells are bounded posteriorly by the inner table.

The ophryon is the concavity situated above the glabella and indicates the median vertical extension of the sinuses. The floor of the frontal cells is formed by the orbital plate of the frontal bone curving upward and outward in conformity with the supra-orbital ridge. The inner table and the floor of the sinuses are very thin and in the young are susceptible to marked distension from exudation. When in this condition they crowd outward into the orbital cavity or displace the floor of the ethmoid cells downward into the nasal cavity.

The frontal sinuses vary in size and number. Not infrequently, only one sinus is found to exist, and in some few cases, the sinus may be entirely absent. Upon exploration, the sinus may sometimes be found to be made up of distinct chambers, separated from the main portion, of the sinus by a thin septum. The positive presence or absence of the frontal sinuses, and their relative size, can only be demonstrated by radiography.

The Ostium Frontale or the Fronto-Nasal Opening.—The opening is funnel-shaped and is situated at the inner and most dependent portion of the floor. The wall of the thin septum forms a part of the canal. The natural course of the canal is slightly backward and downward. The nasal opening is situated beneath the middle turbinated bone in the anterior middle meatus. The infundibulum, as shown in the figure and as described by Gray, is a long flexus canal, situated anteriorly to the bulla ethmoidalis and on the outer wall of the middle meatus. It is often found immediately connecting and forming a part of the fronto-nasal duct. Its mission is to act as a drainage canal for the anterior ethmoidal cells.

The Ethmoid Cells.—The ethmoid cells (cellulæ ethmoidalis) begin to develop five years after birth and are divided by some authorities into three sets, anterior, middle and posterior, and by others into two sets, the anterior and posterior. Turner defines their posi-

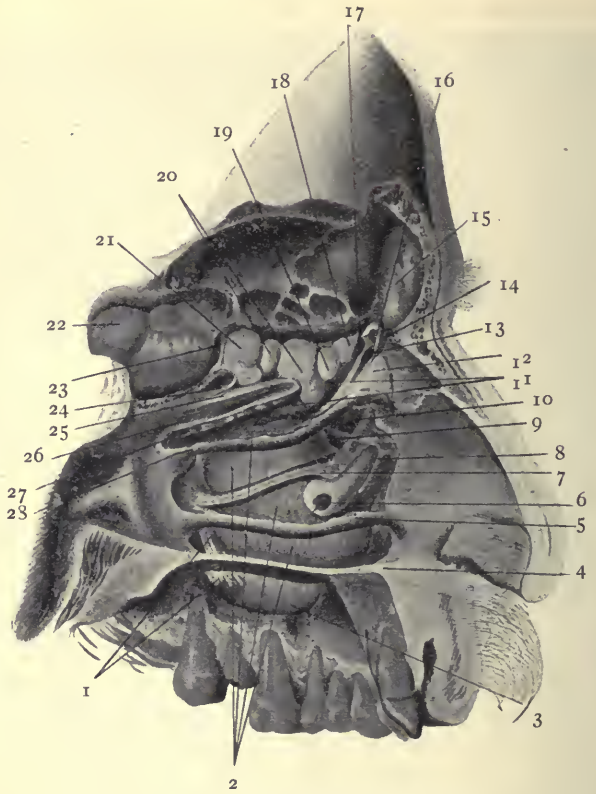

FIG. 34.—THE ACCESSORY SINUSES IN THEIR RELATION TO THE NASAL FOSSÆ. (After *Killian.*)

1, Palatine nerves and vessels; 2, maxillary sinus; 3, alveolar recess of maxillary sinus; 4, floor of nasal cavity; 5, lower margin of inferior turbinal bone; 6, opening of lachrymal canal; 7, basilar lamina of lower turbinal bone; 8, prelachrymal recess of maxillary sinus; 9, opening of maxillary sinus; 10, infundibulum of middle meatus; 11, ethmoidal bulla; 12, first frontal cell; 13, second frontal cell; 14, Schaeffer's space; 15, frontal sinus (third frontal cell); 16, frontal recess of middle meatus; 17, opening of frontal sinus; 18, fourth frontal cell; 19, upper intermediate cell of middle meatus (cell of ethmoidal bulla); 20, ascending cell of superior meatus; 21, cell of highest meatus; 22, sphenoidal sinus; 23, opening of sphenoidal sinus; 24, highest antrum; 25, superior turbinal bone; 26, superior meatus; 27, basilar lamina of middle turbinal bone; 28, lower margin of middle turbinal bone.

tion more clearly when he says: "All the cells which communicate with the meatus of the nose, below the line of the origin of the middle turbinated bones, are anterior ethmoid cells, and those which communicate with the superior meatus above the middle turbinated bones are posterior ethmoid cells."

The lateral mass of the ethmoid bone, containing the ethmoid cells, is bounded anteriorly by the lachrymal bone and nasal process of the superior maxillary, and posteriorly by the sphenoid and turbinated bones and the orbital process of the palate bone. The outer wall is formed by a thin perpendicular plate, the os planum. The *lamina cribrosa* forms the superior boundary and separates the nasal and cranial fossæ. The internal wall, which constitutes a part of the upper and outer wall of the nasal fossa, is formed by the middle turbinated bones. The superior and middle turbinated bodies are the inter-nasal projections of the ethmoid bones, differing in this respect from the lower turbinal, which is an independent bone articulating with the superior maxillary bone. The middle turbinate bears the greatest pathological relationship to the ethmoid cells. Within the middle turbinated body, which normally consists of thin scroll-shaped bones, are sometimes found cells resembling histological structure. In one thousand cases observed by Lattison, ten contained cells. The cells are formed more frequently in the anterior half of the middle turbinal. They may exist independently or connect with one of the ethmoid cells. The ostia of the turbinal cells may open on the external surface, either in the middle meatus or the lateral ridge. The cells are susceptible to disease, varying in no respect from the pathology of sinusoidal infection. The relative position, size and number of the anterior air spaces of the ethmoid body, will vary from one to five in different individuals. They usually consist of one or two chambers, although cases have been noted in which seven or eight have been found (Turner).

As a general rule, the anterior cells outnumber the posterior. The communication of the anterior cells with the middle meatus, is through several small ostia. The ostia of the anterior cells open into the infundibulum and drain into the hiatus semilunaris, which is directly beneath the bulla ethmoidalis and above the uncinate process of the

FIG. 35.—SAGITTAL SECTION OF SKULL SHOWING A FREEMAN'S SPHENOIDAL BOUGIE IN POSITION.

ethmoid bone. The ostia of the posterior cells open directly into the superior meatus. In a normal skull the posterior ethmoid cells extend downward from the attachment of the middle turbinated bone to the thin wall separating the sphenoid cells. As a rule, there is no communication between the ethmoid antrum and the sphenoid cells.

The posterior ethmoid cells, composed of one, two or three spaces. varying in size and position, open into the superior meatus through one or both ostia. The mucus and pus from the posterior ethmoid cells may, according to the position of the head, drain backward over the posterior surface of the middle turbinated bone into the naso-pharynx or flow forward over the anterior margin of the middle turbinated bone.

The general shape of the posterior cells may vary in individuals, sometimes extending into the sphenoid bone forming a spheno-ethmoidal cell. As a rule, the posterior cells open from one ostium situated in the superior meatus. The mucous membrane covering the ethmoid cells is of a stratified ciliated variety, containing mucous glands.

The Sphenoid Sinuses.—The sphenoid sinuses are two in number, situated in the anterior portion of the body of the sphenoid bone below and anterior to the optic commissure and posterior to the ethmoid cells. Separating the two cavities is a vertical bony septum. The sinuses are fully formed about the tenth year of life. The cavity is irregular in form. Its transverse diameter corresponds to that observed in the posterior wall of the ethmoid cells. The height of the cells varies from six to twelve mm.

The plate of bone separating the cells from the cranial cavity is very thin, often less than one mm. It will be observed that the more dependent portion of the floor of the cell is located at its junction with the ethmoid bone. The ostium is situated in the anterior wall above the floor, draining into the spheno-ethmoid recess. The thickness of the wall varies in individuals. As a rule, it is very thin and easily perforated. The epithelium covering the sinus is the same as that found in the ethmoid cells. The position of the sphenoid cells is of especial interest from a surgical standpoint, on account of the important organs in close proximity.

FIG. 36.—SAGITTAL SECTION OF HEAD SHOWING MIDDLE TURBINATED BODY REMOVED.

1, Probe passed into the ostium maxillare.

Above the cells are found the optic commissure and pituitary body. The internal carotid, cavernous sinus, superior maxillary nerve and ophthalmic vein, all pass near the lateral wall.

The Accessory Air Cells of the Sphenoid Bone.—The accessory air cells of the sphenoid bone have been especially described by Hajek and Zuckerkandl. H. Beman Douglass and others in his

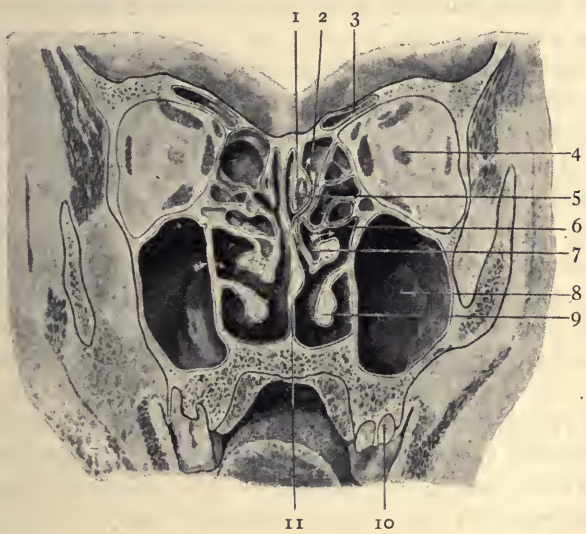

FIG. 37.—VERTICAL CORONAL SECTION THROUGH BOTH NASAL CHAMBERS AND MAXILLARY ANTRA.

1, Sulcus olfact.; 2, posterior ethmoid cell; 3, frontal sinus; 4, optic nerve; 5, posterior ethmoid cell; 6, middle meatus; 7, middle turbinated body; 8, maxillary sinus; 9, inferior turbinated body; 10, first molar; 11, nasal septum. (After *Turner*.)

country have called special attention to the surgical importance of the small accessory sinuses situated in the wing of the sphenoid bone, distinct from the sphenoid cells proper and emptying into the posterior cell or recesses spheno-ethmoidalis.

The great importance of the knowledge of such accessory sinuses is apparent in those cases of suppurative inflammation of the sphenoid and ethmoid sinuses, which we are reasonably certain to have

cured but from which a purulent discharge still issues. That the cells are easily located or may be opened without danger, is to state a bad proposition and the young operator would be wiser under such circumstances to trust the operative procedure to men skilled in the surgical technique of this region.

The Maxillary Sinus.—The maxillary sinus or antrum of Highmore is formed during fetal life by a process of evagination of the mucous membrane and absorption of bone within the upper jaw. This continues up to about the twenty-fifth year of life.

At birth the antrum is simply a vertical slit in the maxilla. The mucous membrane is like that of the respiratory region of the nose and is of the pseudo-stratified variety, containing goblet cells. The inner layer is in direct opposition with the bone acting as a periosteal covering. The avenue of communication with the nose is through the maxillary ostium (Fig. 37) situated within the middle meatus. The size of the ostium varies in individuals. Its location is just beneath the roof of the antrum. The maxillary antrum may be provided with more than one ostium, due to an accident in embryological growth.

The average dimensions given by Turner, are: Vertical height above the first molar tooth, 3.5 cm. (about one and one-half inches); the transverse breadth, 2.5 cm. (one inch); the antero-posterior depth below the roof, 3.2 cm. (one and one-half inches).

The antrum may be as much smaller than the normal one due to faulty absorption of bone or faulty mesodermic development. Before attempting any surgical operation of the antrum, the wall separating the antrum from the nasal cavity should be explored.

The lymphatic supply, which is imperfectly understood by investigators, empties into the anterior and posterior trunks of the nasal fossæ.

CHAPTER V.

ANATOMY OF THE THROAT AND TRACHEA.

The Pharynx.— The pharynx is that portion of the respiratory tract posterior to the nasal fossa and buccal cavity, anterior to the cervical vertebræ, bounded above by the basilar process of the occipital bone and extending downward to an imaginary horizontal line drawn through the base of the cricoid cartilage and sixth cervical vertebræ and is continuous with the esophagus and larynx.

The blood supply is derived from the external carotid artery. The facial artery gives off the ascending pharyngeal, the tonsillar and the ascending palatine. The superior thyroid is distributed to the upper portion of the larynx and the inferior thyroid to its lower portion.

The pharynx is subdivided into the naso-pharynx, the oro-pharynx, and the laryngo-pharynx. The naso-pharynx extends to the edge of the soft palate; the oro-pharynx from this to a line drawn through the horn of the hyoid bone; the laryngo-pharynx extends from this termination to a plane drawn through the base of the cricoid cartilage.

The mucous membrane covering the naso-pharynx is of the stratified ciliated variety. The oro-pharynx is lined with squamous epithelium, and the laryngo-pharynx with squamous and ciliated epithelium.

The stratified squamous variety of epithelium covers the vocal cords, arytenoid cartilages, columnal cartilage and the remaining portion. The conglomerate and follicular glands are both numerous in the naso-pharynx. The conglomerate glands are numerous over the pharyngeal surface of the soft palate and the posterior wall of the Eustachian meatus.

The follicular glands, or the *tonsil of Luschka*, often spoken of as the third tonsil, occupy the vault of the pharynx and frequently extend downward, encroaching upon the Eustachian orifice. They are

present at birth but should undergo atrophy about the tenth year of life.

Rosenmüller's fossæ are situated on each lateral wall of the pharynx, about midway between the Eustachian orifice and the post-pharynegal wall.

The function of the naso-pharynx is that of a resonant chamber

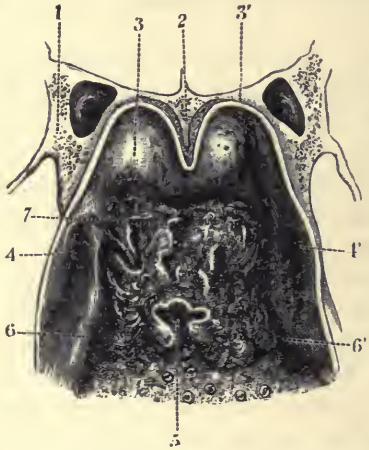

FIG. 38.—POSTERIOR WALL OF THE PHARYNX. (After *Luschka.*)

1, Sphenoid; 2, vomer; 3, posterior end of nasal fossa; 3′, cut edge of mucous membrane; 4, 4′, opening of Eustachian tube; 5, opening of median recess or bursa pharyngea; 6, 6′, recessus pharyngeus lateralis; 7, adenoid tissue of pharynx.

for voice modification, the preparation of warm, moist air for the middle ear and lungs, and drainage for the nasal cavity.

The mucous membrane of the oro-pharynx is supplied with mucous glands. Two important glandular structures, which are part of Waldeyer's lymphoid ring, the pharyngeal and lingual tonsils, are present in this region of the oro-pharynx. The posterior opening of the mouth and connection with the oro-pharynx, are called the fauces or isthmus faucium (Fig. 39). Within this chamber and constituting a part thereof, is the uvula, which is a part of the soft palate, the anterior and posterior pillars, the two pharyngeal tonsils and the

lingual tonsil. Between the base of the tongue and the epiglottis are the two glosso-epiglottidean pouches and three glosso-epiglottid-

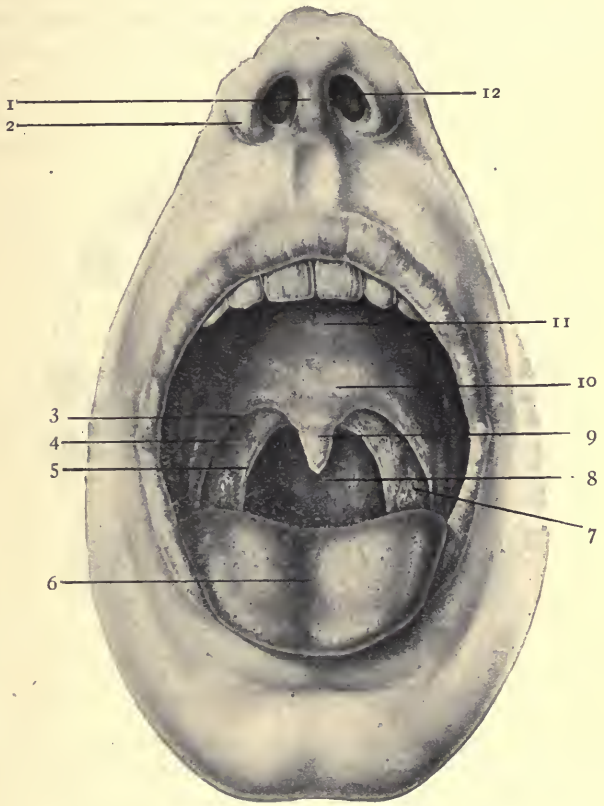

FIG. 39.—ANTERIOR VIEW OF MOUTH.

1, Columna; 2, ala of nose; 3, anterior pillar of fauces; 4, recess of fauces; 5, posterior pillar of fauces; 6, tongue and median raphé; 7, tonsil; 8, posterior wall of the pharynx; 9, uvula; 10, soft palate; 11, hard palate; 12, anterior naris. (After *Deaver*.)

ean folds. The oro-pharynx plays a very important part in voice production and deglutition.

The anterior pillar of the fauces is formed by the palato-glossus

muscle, which has its beginning at the palatine aponeurosis and its ending at the side and back of the tongue. The posterior pillar is formed by the palato-pharyngeus muscle, which arises from the soft palate, passes downward and backward from the tonsil, joining the stylo-pharyngeus and with that muscle is inserted into the pos-

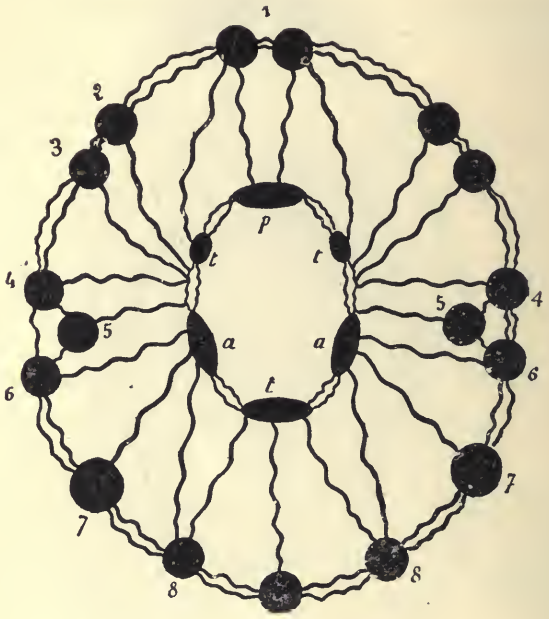

FIG. 40.—DIAGRAM OF WALDEYER'S LYMPHATIC RING AND ITS CONNECTION WITH THE LYMPHATIC GLANDULAR SYSTEM. (After *Escat and Lamb.*)

1, Retro-pharyngeal; 2, styloid; 3, lateral pharyngeal; 4, behind sterno-mastoid; 5, bifurcation; 6, in front of sterno-mastoid; 7, angle of jaw; 8, hyoid; 9, subhyoid; *p*, pharyngeal; *t*, tubal; *a*, faucial; *l*, lingual tonsils.

terior border of the thyroid cartilage, under the superior cornu. The epithelium covering the two pillars is a continuation of that of the oral and pharyngeal cavity.

Lingual Tonsil.—At the base of the tongue, above the glosso-epiglottic fold and back of the circumvallate papillæ, is situated the

lingual tonsil, which is composed of true adenoid tissue, secreting a serous and mucous liquid. Small crypts, lined with stratified pavement epithelium, are discernible throughout the tonsil. On account of its peculiar position, irritation of this region is frequently observed. In disease of the lingual tonsil, large, venous blood vessels or varices may be frequently observed covering the base of the tongue and lingual tonsil.

The Faucial Tonsils.—The tonsils (amygdalæ) are two in number and are situated on either side of the fauces between the anterior and posterior pillars. Their size is variable. They are composed of true lymphoid tissue, being a part of Waldeyer's lymphoid ring and are almond-shaped in character. On the inner side are twelve to fourteen openings or follicles, covered with stratified epithelium, which dips down into the glands.

The nerve supply is from Meckel's ganglion and from the glossopharyngeus. The arterial supply is from the facial, which gives off the lingual, palatine and tonsillar, the ascending pharyngeal from the external carotid, the descending palatine and a sprig from the small meningeal, both being branches from the internal maxillary. The most important artery of the tonsil and the one from which hemorrhage is most frequent, is the tonsillar, which enters the tonsil near the center of the attachment to the lateral wall. The severe hemorrhage following tonsillotomy or tonsillectomy is usually from this artery. In those past middle age a sclerosis of the artery sometimes occurs, which makes hemorrhage certain, following the removal of the tonsils.

The venous supply ends in the tonsillar plexus on the outer side of the tonsil.

The lymphatic supply of the pharynx is very profuse, being (Fig. 40) located more especially within the mucous membrane and is more numerous in the superior and posterior wall. The pharyngeal tonsil is, according to Poirier, Cuneo and Delamere, very rich in lymphatics. The laryngo-pharynx has little or no lymphatics. The ducts empty into the retro-pharyngeal glands or the internal jugular chain.

The function of the tonsils is imperfectly understood. By some

they are thought to be a primogenial source of the lymphocytes and leukocytes. The function of the tonsil is presumed to be the digestion of microörganisms, which find their way into the tonsils and to furnish a secretion to moisten the tonsils and pharynx, and by so doing, aid in deglutition.

Above the tonsil and between the anterior and posterior pillars is situated the fossa supra-tonsillaris. It is triangular in shape, its

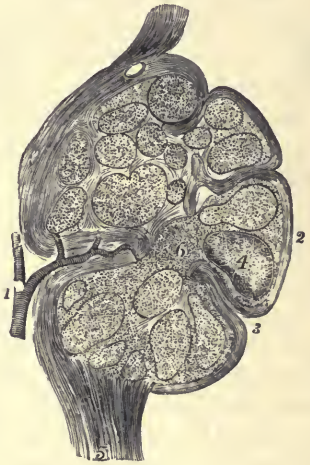

FIG. 41.—VERTICAL SECTION OF THE TONSIL. (After *H. E. Clark.*)

1, Hilum with vessel entering it; 2, epithelial external layer; 3, mucous-crypt; 4, lymphoid nodule; 5, submucous tissue of the fauces terminating in the tonsil; 6, interstitial connective tissue.

border being the anterior and posterior pillars. It is of especial interest on account of the frequency of peritonsillar inflammation. Frequent attacks of inflammation of the tonsils may form adhesions with the pillars, producing pouches or pathological culture tubes for the propagation of infectious microörganisms.

The Larynx.—Within the region of the laryngo-pharynx is situated the most important organ of voice and speech, the larynx. The larynx is composed of the cricoid, thyroid, epiglottis, cartilaginous structures, and is situated below the base of the tongue and is in direct

connection with the trachea, at the base of the cricoid cartilage. In addition, we have three sets of cartilage, arranged in pairs, the arytenoid, the cornicula laryngis (Santorini), and the cuneiform (Wrisberg). The thyroid and cricoid are composed of hyaline cartilage; the arytenoids are composed of hyaline cartilage with the

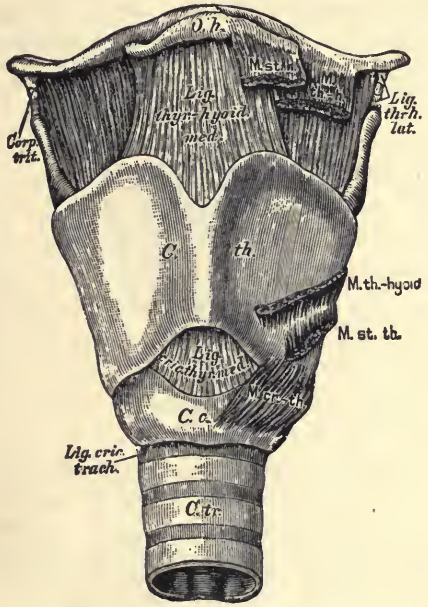

FIG. 42.—*O.h.*, *Os.*, Hyoides; *C. th.*, thyroid cartilage; *Corp trit.*, corpus triticeum; *C.c.*, cricoid cartilage; *C.tr.*, tracheal cartilage; *Lig. thyr.-hyoid med.*, middle thyro-hyoid ligament; *Lig. th.-h. lat.*, lateral thyro-hyoid ligament; *Lig. cric.-thyr. med.*, middle crico-thyroid ligament; *Lig. cric.-trach.*, crico-tracheal ligament; *M.th.-hyoid.*, thyro-hyoideus muscles; *M. st.-th.*, sterno-thyroideus muscle; *M. cr.-th.*, crico-thyroideus muscle. (After *Holden.*)

exception of the uppermost portion, which is composed of yellow elastic cartilage. The cricoid cartilage is so called from its resemblance to a signet ring. Its vertical measurement is one inch on its lateral wall and rests upon the anterior superior surface. The triangular upper half of the thyroid cartilage extends outward, varying

in individuals and forms the Adam's apple (pomum Adami). The superior margins of the cartilages curve gently backward and end in the long projection, known as the right and left superior cornu of the thyroid. The lower margins curve in a like manner, with the exception of the lower projection, or the lower cornu, which is short and blunt.

To the superior cornu are attached the lateral thyro-hyoid ligaments. The inferior cornu, as shown in the illustration, are attached

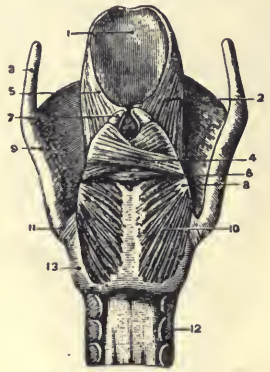

FIG. 43.—THE MUSCLES OF THE LARYNX VIEWED FROM BEHIND. (After *Sappey and Hughes.*)

1, Epiglottis; 2, aryteno-epiglottideus; 3, superior cornu of thyroid; 4, oblique fibers of arytenoideus; 5, aryteno-epiglottidean fold; 6, deep fibers of arytenoideus; 7, corniculum laryngis or cartilage of Santorini; 8, muscular angle of arytenoid; 9, thyroid cartilage; 10, crico-arytenoideus posticus; 11, articulation of cricoid with thyroid; 12, trachea; 13, cricoid cartilage.

to the median lateral wall of the cricoid by the posterior superior ceraro-cricoid and the posterior ceratoid ligaments. In front, at the elliptical space, the two cartilages are connected by the median crico-thyroid ligaments. The arytenoid cartilages are two in number and triangular in form. They occupy a position on the superior margin of the posterior part of the cricoid cartilage, to the right and to the left of the median line. Their height is usually one-half inch and their diameter one-quarter inch at the base. The apex of each pyramid is capped by a small cartilage, the cartilage of Santorini.

To the outside and (Fig. 44) slightly above the cartilage of Santorini are situated the cartilages of Wrisberg. Their anatomical position is interesting on account of the liability of this region to tubercular and syphilitic infections.

The epiglottis is a fibro-cartilaginous structure, situated in the median line at the base of the tongue and projects over the larynx like a valve. Its apex is attached to the median notch of the thyroid cartilage by the thyro-epiglottic ligament. It is connected to the posterior surface of the os hyoides by the hyo-epiglottic ligament. Laterally, two folds of mucous membrane connect the epiglottis with the arytenoid cartilage, designated the aryteno-epiglottic fold.

The aryteno-epiglottic folds continue backward, enclosing the cartilage of Santorini and filling the space between the upright walls of the arytenoid cartilages. The anterior surface of its apex is attached to the base of the tongue by the three glosso-epiglottic folds.

The muscles supplying the larynx are both intrinsic and extrinsic. The extrinsic are those found outside the larynx and are sterno-hyoid, sterno-thyroid, aryteno-hyoid and thyro-hyoid, the function of which is the depression of the hyoid bone and the elevation of the thyroid cartilage, and the glosso-hyoid, mylo-hyoid, stylo-hyoid and hyo-glossus, whose function is to elevate the larynx.

The intrinsic muscles, or those within the larynx, are eleven in number, arranged in five pairs with one in the middle.

The crico-thyroid muscle is attached to the outside portion of the thyroid cartilage and passes downward and forward to the anterior portion of the cricoid cartilage, and by a process of drawing upward, the anterior portion with the attached arytenoid cartilage is tilted backward and downward, thus making the vocal cords tense.

The nerve supply is from the external laryngeal nerve. A paralysis is presumed by Gowers to have some influence upon the production of high notes.

Fibers of the thyro-arytenoid pass from the posterior surface of the thyroid cartilage at its angle parallel with the vocal cords and are inserted into the anterior surface of the arytenoid cartilage. The muscle at its inner surface joins the vocal cords. The muscle is subdivided by anatomists into the thyro-arytenoideus externus and the

thyro-arytenoideus internus. The two muscles are inseparable. The former is a broad muscle, situated externally and in close apposition with the crico-thyroid membrane. It is inserted in the outer border and muscular process of the arytenoid. Some of the fibers are continuous with the arytenoid muscle. The muscle draws the outer portion of the arytenoid cartilage forward and this turns the inner portion of the arytenoid cartilage close together and adducts the cords.

The thyro-arytenoideus internus is a slender muscle in close apposition with the vocal cords. It takes its origin at the angle between the two alæ of the thyroid cartilages and with the vocal cord is inserted into the outer portion of the processus vocalis. The muscle shortens the cord. A paralysis renders the cord concave.

The crico-arytenoideus posticus passes from the outer surface of the cricoid cartilage upward and outward to the muscular process of the arytenoid cartilage. The function is to draw the outer portion of the arytenoid cartilage downward, thus separating or abducting the vocal cords. The muscle is supplied by the laryngeal nerve. A paralysis of one or both muscles approximates the vocal cords.

The fibers of the crico-arytenoid lateralis pass from the upper border of the cricoid cartilage to the outer portion of the arytenoid cartilages, draw the cartilages forward and approximate the cords.

The arytenoid is a single muscle passing posteriorly from one arytenoid cartilage to the other and has its attachment on the posterior concave surface. The function of the muscle is the adduction of the cords.

The vocal cords are composed of yellow elastic tissue extending from the inner angle of the thyroid cartilage to the processus vocalis of the arytenoid cartilage. The outer surface is in direct apposition to the internal part of the thyro-arytenoid muscle. The size and length of the vocal cords vary in individuals. The normal voice, with its complete range of tone, is essentially dependent for its production upon the vocal cords. The general physiology of the voice will be considered under a separate subdivision.

The ventricular bands, or false vocal cords, are so named because it is supposed they have no influence upon voice production. There

are two crescentic folds of mucous membrane enclosing the superior thyro-arytenoid ligaments parallel to the true vocal cords, slightly above and to the outer margin of the cords. They project into the larynx from the lateral wall and with the true vocal cords form the two lateral ventricles, which are named the ventricles of Morgagni. The functions of the ventricles of Morgagni, which contain many mucous and serous glands, is to supply moisture to the vocal cords. The ventricles contribute in a slight measure to voice production and aid in preventing the escape of air from the lungs (Brunton and Cash).

The mucous membrane of the greater portion of the larynx is covered with a stratified, columnar, ciliated epithelium resting upon a thick submembrane. Goblet cells are contained within the epithelium. The epithelium covering the true vocal cords, part of the arytenoid cartilages and the free margin of the epiglottis, is of the stratified, squamous variety.

The sudden change in the character of the epithelium, as pointed out by Frederick, of Leipzig, in a measure accounts for the slowness with which acute catarrhal inflammation extends from the oropharynx into the larynx, and for this reason acute laryngitis and pharyngitis seldom extend to the upper air passages.

The nerve supply of the larynx is received from the superior and inferior or recurrent laryngeal nerves, branches of the vagus. Sensory fibers from the superior laryngeal branch furnish acute sensibility to the glottis. These fibers carry impressions to the medulla oblongata while motor impulses are transmitted by the inferior laryngeal. By this mechanism, foreign bodies and irritating gases are prevented from gaining entrance to the lungs by closure of the glottis.

The inferior laryngeal is supposed to supply motor impulses to all the muscles with the exception of the crico-thyroid, which receives motor impulses from the superior laryngeal. The inferior recurrent laryngeal nerve contains both adductor and abductor fibers. The adductor fibers are presumed to be stronger than the abductor fibers.

The arterial blood supply is derived from the superior and inferior thyroid arteries. "The venous supply empties into the superior thyroid veins. The capillaries are very fine and lie directly beneath

the epithelium." The lymphatic network is situated beneath the capillaries.

Voice and Speech.—The purity of the voice is dependent essentially upon the vocal cords. The loudness, pitch, quality and timbre are dependent upon the normal condition of the upper air passages, somewhat, although the essential factor in voice production is a highly developed voice center in the brain combined with a well developed aural apparatus. No great singer ever lived who did not have this highly developed center. The same rule may be applied to artists or painters. It would be better to secure a normal nose or throat in a professional singer, though one should not overlook the fact, that in most cases, the voice has been brought to a high state of development with abnormal conditions present, and to remove them, regardless of any consideration, might predispose to a reduction of the quality or timbre of the voice. To make myself perfectly plain, I would never remove hypertrophied tonsils in a singer of note unless the voice was affected as a result of some disease of the tonsils. Palliative treatment of any local tonsillar disease is indicated. Nasal obstruction or post-nasal hypertrophies can be removed with probably no possibility of injury to the vocal cords unless infection of great severity supervenes.

The voice is produced by certain vibrations of the vocal cords, previously approximated and tense. The force of the expired air is controlled by action of the phrenic and intercostal muscles.

The speech area is situated in the base of the third frontal convolution. From this area emanate impulses which pass along appropriate fibers of the pyramidal tract of the bulb and these produce impulses by which the word is spoken (Foster). Incoördination of the muscular movements of the larynx, paralysis of the different conconducting fibers, diseases of the cortical centers or diseases of the vocal cords may result in partial or complete loss of voice.

One great essential to the production of voice is a clear understanding of the function of respiration. Three methods of breathing are universally known, clavicular, costal and diaphragmatic or abdominal. Among singers all these methods have been extensively advocated. The clavicular probably has fewer advocates than the other two.

The diaphragmatic method offers the greater advantage in the production of pitch and quality in the voice. In the abdominal method of breathing, a greater amount of air is taken into the lungs, and steadiness, power and volume are added to the force of the expired air. The greater the number of vibrations in a given length of time the higher the pitch of the voice.

The larynx is seen to be open during rest. This is also the normal condition during respiration. The cadaveric condition is that seen

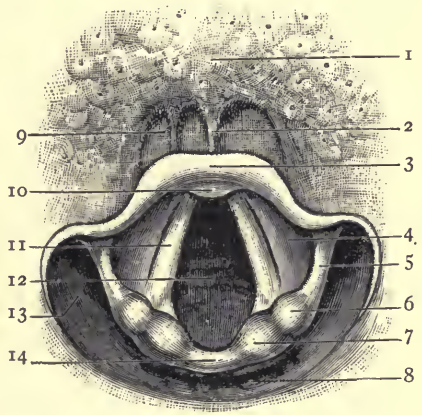

FIG. 44—VIEW OF INTERIOR OF LARYNX AS SEEN DURING INSPIRATION.

1, Base of tongue; 2, median glosso-epiglottidean fold; 3, epiglottis; 4, fossa innominata; 5, aryteno-epiglottidean fold; 6, cartilage of Wrisberg; 7, cartilage of Santorini; 8, pharynx; 9, vallecula; 10, cushion of epiglottis; 11, true vocal cord; 12, rima glottis; 13, sinus pyriformis; 14, arytenoid commissure. (After *Morris.*)

in death, when the larynx is partially open. The glottis is much narrower at this time than in the living subject. The vocal cords with the cartilages of Santorini are more or less approximated, according to the note sounded or the word spoken. It is only by assuming a rigid position that the cords are set in vibration. When the recurrent laryngeal of one side is cut or paralyzed, the shape of the glottis changes, the cord on that side remaining at rest while that of the opposite side approximates the median line in phonation. In bilat-

eral paralysis, the abductor muscles fail to respond to stimulation, inspiration is disturbed and the voice is lost. When the recurrent laryngeal is stimulated the cords are brought into apposition.

Voices are classified, according to range, into soprano, mezzo-soprano, contralto, tenor, baritone and bass. The range of tone of the voice is dependent upon the size and length of the vocal cords, combined with the peculiar coördination of the muscular structure

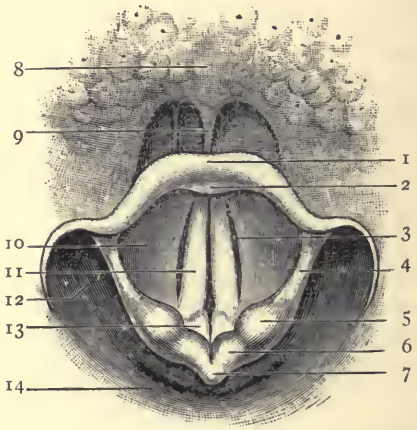

FIG. 45.—VIEW OF INTERIOR OF LARYNX AS SEEN DURING VOCALIZATION.

1, Epiglottis; 2, cushion of epiglottis; 3, ventricle; 4, aryteno-epiglottidean fold; 5, cartilage of Wrisberg; 6, cartilage of Santorini; 7, arytenoid commissure; 8, base of tongue; 9, median glosso-epiglottidean fold; 10, fossa innominata; 11, true vocal cord; 12, sinus pyriformis; 13, processus vocalis; 14, pharynx. (After *Morris.*)

of the larynx, which necessarily varies in individuals. The old theory that the difference in the bass and tenor voice is dependent upon the length of the vocal cords is, in a great measure, erroneous.

The size of the larynx varies, being larger in men than in women. At the age of puberty in boys, the voice undergoes rapid change in pitch. During this metamorphosis more or less congestion of the mucous membrane is present, all of which accounts for the peculiar tone of the voice. It is also apparent that the tongue, palate, with

its varied arched conditions, nasal and post-nasal spaces, teeth and lips, all on their part, add a well-observed character to the voice.

"Speech is a combination of vocal sounds, which are classified as vowels and consonants and are joined together to make syllables. Speech may be distinguished from singing, partially by the fact that the sounds in the first case are more especially articulate or formed in the mouth, while in the latter their quality is only modified by the mouth.

"In singing, the tone is sustained at the same pitch for a considerable length of time, while in speaking, the voice is continually sliding up and down the vowel sounds" (Henry Sewell).

The Trachea.—The trachea is a patent tube, somewhat flattened behind, composed anteriorly of a series of hyaline cartilaginous rings, sixteen to twenty in number, and posteriorly by a membranous wall containing, on its internal surface, muscular fibers. The rings of cartilage are connected longitudinally one with the other by a tough, elastic and collagenous membrane.

The tube begins at the lower border of the cricoid cartilage and ends at about the upper border of the fifth dorsal vertebra, subdividing into the right and left bronchus. The right bronchus is larger and shorter than the left and is in a more direct line with the trachea.

The length of the trachea in the adult male is about four to four and one-half inches, and is generally one-half inch shorter in the female adult.

The calibre of the infant and adult varies considerably, and according to Wharton and Curtis, the diameter of the trachea under eighteen months of age is about four millimeters, from two to four years of age, eight millimeters, and from eight to twelve years, ten millimeters.

The long axis of the trachea corresponds, as a rule, to the median line of the body. However, it may depart from the median line, and, in exceptional cases, be slightly deflected.

The trachea is lined with a stratified ciliated columnar epithelium. Numerous branched tubulo-acinal glands of the mucous variety supply moisture to the mucosa.

The sensitive nerve supply is from the superior laryngeal nerve. According to Long and Luschka, sensitive nerve fibers of the superior

laryngeal anastomose with the recurrent laryngeal which supplies motor fibers, thus the recurrent laryngeal indirectly supplies both motor and sensory fibers to the mucosa.

Cough may not alone be due to some peripheral or central irritation of superior laryngeal fibers in the larynx or trachea, but may probably be due to an excitation of the inferior or recurrent laryngeal.

The general structure of the bronchi is the same as that of the trachea, containing incomplete cartilaginous rings and a continuation of the mucous membrane with glandular structure as observed in the trachea.

CHAPTER VI.

BACTERIOLOGY AND PATHOLOGY OF THE EAR, NOSE AND THROAT.

Bacteriology of the Ear, Nose and Throat.—On account of the cutaneous covering of the external ear, there is little to be said in regard to bacteriology of this region. The most frequent organisms causing disease of the auricle are the staphylococcus pyogenes aureus, seen in furuncles, streptococcus pyogenes, found in erysipelas, and not infrequently saprophytes, parasites, and blastomycetes.

The cocci involving the middle ear are of greater variety than those involving the auricle. They usually find their entrance through the Eustachian tube, the membrana tympani from traumatism, or the blood and lymph streams. It was shown by Preysing in 1899 and later demonstrated by Hasslauer that bacteria are not found in the normal middle ear. The cause of this immunity is supposed to be due more especially to the cilia of the Eustachian tube, which constantly moves toward the pharynx during the acts of breathing, swallowing and eating, thus preventing materially the entrance of microörganisms into the middle ear. Among those found as active causes of inflammation of the middle ear are the streptococcus pyogenes, occasionally the tubercle bacillus, pneumococcus of Fränkel, Pfeiffer's bacillus of influenza, the bacillus of Friedlander and the staphylococcus pyogenes albus and aureus, Löffler's diphtheria bacillus, the colon bacillus and the bacillus pyocyaneus (Gouher), also found by Stern in suppurating ear, pseudo-diphtheric bacillus in croupous otitis (Schilling), actinomycosis (Laufel), bacterium aerogenes (Scheibe), blastomycetes found in serous exudation following paracentesis (Barrago-Ciarelli), gonococcus (Trow) and the bacillus coli (Stern). Levin believes that the great majority of cases of diphtheria of the middle ear following pharyngeal diphtheria, are

due to the toxins circulating in the blood and not to the extension of the disease through the tube. Leutert believes the streptococcus to be the cause of scarlatinæ otitis. Just how the infection of measles and scarlet fever reaches the middle ear is a subject on which authorities differ, many believing the avenue of entrance to be through the Eustachian tube, while others believe the blood stream to be the means of entrance. The form of infection more frequently found in abscess of the mastoid is the streptococcus. In sixty-three cases of abscess of the mastoid following acute suppuration of the ear, Leutert found streptococcus thirty-eight times in pure culture, pneumococcus eleven times in pure culture, staphylococcus five times in pure culture, tubercle bacilli two times in pure culture and mixed infection in the other cases.

In the nose may frequently be found the staphylococcus pyogenes aureus, streptococcus pyogenes, diplococcus of Fränkel and Weichselbaum, tubercle bacillus found in those living with tubercular patients and the Klebs-Löffler bacillus of diphtheria. These bacteria are innocuous, though at any time a lowering of vitality or irritation of the tissues may cause them to become a source of active inflammation. Thus it is necessary that we take the same precautions in preparing our cases for any surgical operation in the nose and after dressing as the abdominal surgeon would in laparotomy.

The mouth and pharynx are open to infection through the medium of food and water, through the air, breathed directly into the mouth, or through the nasal cavity.

The mouth is deprived of ciliated epithelium or vibrissæ, whose function is to antagonize the entrance of bacteria, consequently, when open and especially in mouth-breathers, great numbers of organisms find entrance.

Within the teeth and tonsils food particles often find lodgment, which give off ptomains which are potent factors as a cause of acute pharyngitis and laryngitis.

We previously called attention, under Anatomy of the Tonsils, to the presence within the tonsils of polyformed nuclear leukocytes, which in a measure destroy bacteria which may have found entrance into the crypts of the tonsils. The crypts of the tonsils in apparently

healthy individuals may not infrequently contain many tubercle bacilli and other microörganisms. Within the mouth and pharynx, in active catarrhal or ulcerated conditions, may be found the staphylococcus, the streptococcus pyogenes aureus, albus and citreus, and Vincent's spirillum and fusiform bacteria. In ulceration of the throat, due to syphilis, the spirochæte pallida may sometimes be found.

The diphtheria bacillus was discovered in 1883 by Klebs and

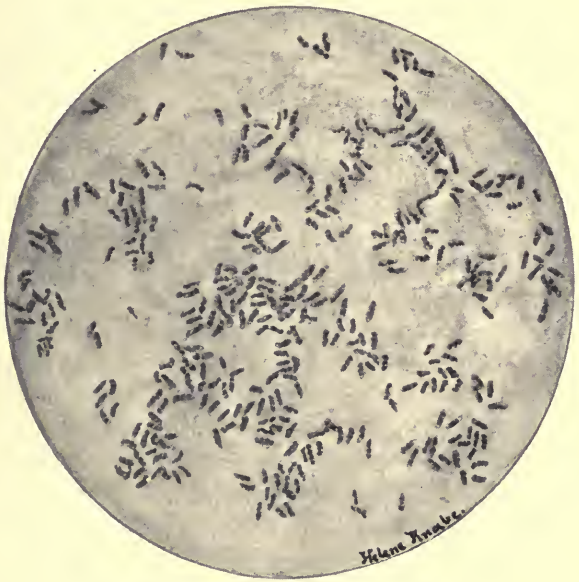

FIG. 46.—KLEBS-LOFFLER BACILLUS.

Löffler. The bacteria is the exciting cause of diphtheria (Fig. 46). The Klebs-Löffler bacillus is non-motile, short, thick, club-shaped and slightly curved, from two or six mikrons in length and two to eight mikrons in breadth. It stains with Ziehl's aniline-oil-water-gentian-violet and with Löffler's alkaline methylene-blue solution. Neisser's stain may be used when differentiation from the false diphtheria bacilli is necessary.

With a platinum loop, heated and subsequently cooled, a small particle of the exudation from the mucous membrane affected is spread upon a cover glass, dried and stained. It is frequently necessary to grow a culture of the bacilli as microscopical examination may be negative. For this a solidified blood serum, furnished in culture tubes, by Parke, Davis & Co., Mulford & Co., and other bacteriological laboratories, should be used. The platinum point is again heated, cooled and passed over the infected area. The adhesive particles are deposited upon the blood serum, gently rubbing the platinum point over the surface of the blood serum. In twenty-four hours in a warm temperature, the growth is observed as a round, grayish-white, glistening elevation, about the size of a pin head. If exposed longer than twenty-four hours the grayish-white elevation becomes yellowish.

The disease may be transmitted from one individual to another by kissing, coughing and through the clothing.

The organisms may remain in the ear, nose or throat for a number of weeks after the inflammation has passed away.

In tonsillitis the streptococcus pyogenes, the staphylococcus or the bacillus of Friedlander is frequently present. In those cases suffering from tuberculosis of the lungs the tubercle bacillus may sometimes be found in great numbers. The bacillus of typhoid fever may often be present in the mouth of those suffering from typhoid fever; the leptothrix in the teeth is presumably a cause of mycosis tonsillaris, the ray fungus a cause of actinomycosis and the bacillus of glanders associated with glanders as a general disease.

Mongardi, in a series of experiments on infection of the mouth, nose and pharynx, makes the following report:

"The organisms used were staphylococcus albus and micrococcus tetragenus from a peritonsillar abscess; staphylococcus aureus from a furuncle of the external auditory meatus; streptococcus from the caseous material of a tonsillar crypt during a serious angina; staphylococcus albus and cereus obtained from skin furuncles, from pus of the ear, from the nose, and associated with streptococcus from a tonsillar exudate; staphylococcus aureus from a case of noma; streptococci from a tonsillar exudate; and streptococci from catarrhal

tonsillitis. The staphylococci injected under the mucous membrane in the nose and under the gums of dogs had no effect. Injected into the tonsil of a dog the animal showed a dejected state, with moderate fever the first day and swelling of the submaxillary glands. All symptoms disappeared in two or three days. The culture injected into the antrum caused some fever with some swelling and slight exophthalmos. On the third day the temperature fell. Streptococci injected into the tonsil of a dog produced phelgmonous angina, obstinate engorgement of the ganglia and high fever for some days. The ganglia remained painful and fluctuating for twenty days when they resolved. The bacillus pyocyaneus had no effect in the nasal cavity of the dog or when injected under the mucous membrane of the turbinate. In the antrum there was great depression and fever for four days and a lively reaction of the ganglia which persisted. In the rabbit, in tonsillar infection, there was death in eighteen hours, while submucous inoculation was fatal in twenty-six to thirty hours. The micrococcus tetragenus had no effect."

Particles of dust entering the larynx are expelled by the ciliated epithelium. By the sudden closing of the glottis, foreign bodies entering the larynx and the accumulation of mucus are expelled by a reflex act of coughing. The larynx is freer from bacteria than any other portion of the upper respiratory tract. The blood may be one avenue of infection. Weiber and Liel have called attention to the inflammation of the middle ear, due to malaria. Metastatic abscess of the external auditory canal may follow gonorrheal infection.

Bacteriology of the Trachea.—Heretofore there has been a paucity of knowledge relative to the presence of bacteria in the trachea. Babcock believes that bacteria do play a conspicuous part in the etiology of acute bronchial inflammation.

It is reasonable to presume that many bacteria reach the mucosa of the trachea and bronchi, and in health are quickly destroyed or become innocuous. A lowering of the vitality of the mucosa, locally or in extensio, enables the healthy organisms present, to become slowly propagated, and leads to a variety of inflammatory conditions.

Infection may spread by continuity of tissue or by the air or lymph channels, and may be the same flora as detected as exciting inflam-

mation in the upper air passages. In acute or chronic disease of the tracts or bronchi, from extension or disease *in loco*, may be found organisms producing diphtheria, measles, scarlet fever, pneumonia, pertussis, tuberculosis, ozena, syphilis, typhoid fever, and the streptococcus pyogenes, staphylococcus pyogenes albus, aureus and citreus, and the bacilli of influenza.

Disease of the trachea and bronchi should probably be considered infectious, and be treated as such.

Opsonins.—Metchnikoff, many years ago, elaborated a theory that certain cells in the blood, so-called leukocytes, were the defenders of the body against bacterial invasion—that whenever bacteria accidently gained admission into the blood stream, the leukocytes rapidly engulfed them within their bodies and removed them from the blood—that when a tissue or organ was injured, a mass of leukocytes was hurried to that tissue or organ to wall it off and prevent bacteria from entering the body.

Wright and Douglass demonstrated some few years ago that there existed in the blood serum a substance which was capable of affecting bacteria in such a way that they could be taken into the body of the leukocytes and digested. They maintained that the leukocytes merely acted as scavengers or mechanical removers of the bacteria that had been killed or altered by some substance present in the blood serum. In view of the rôle of this substance destroying the vitality of the bacteria so that the leukocyte could digest them, this unknown substance was called **opsonin,** derived from the Latin verb, opsono, meaning, I prepare a food.

Little was known regarding the chemical or physical nature of opsonin, but that it was present in the blood serum and not in the cells was shown in the following way. Some blood was withdrawn, care being taken to prevent coagulation, so as not to alter the chemical structure of the serum. This was centrifuged to separate the red and white cells as well as the serum.

The white cells were repeatedly washed in normal salt solution to remove all traces of the serum of the blood, and a platinum loopful of staphylococci mixed with some of these washed white cells. This was incubated for half an hour and then cover glass prepara-

tions were made and examined. None of the white cells had taken bacteria into their bodies.

Some of these washed white blood cells were now mixed with some of the blood serum and the whole inoculated with staphylococci, and incubated as before. Cover glass preparations were made as before but a different picture was seen, for the white cells had taken up many of the bacteria.

This proves that the white blood cells could not of their own accord digest bacteria, but could only do so after the bacteria had been acted on by a substance present in the serum. This substance is called an opsonin, and is the essential factor in producing phagocytosis.

A question naturally arose—what is the relationship between leukocytosis (increase in number of white blood cells) and opsonins. It was soon proved that an experimentally produced leukocytosis did not cause an increase of opsonins in the blood—neither did the leukocytosis, common in infectious diseases, lead to an increase in the number of opsonins present.

Hence the very obvious conclusion that in fighting disease, our effort should be to increase the opsonin content of the blood. As a matter of fact, this is being done in many cases. The most brilliant results have been in cases due to staphylococci (sycosis, furunculosis, acne) and local tuberculous affections, notably lupus. The production of bacterial vaccines has been enormously stimulated and much good will come from it. In chronic otitis media purulenta, due to staphylococci, the use of a properly selected bacterial vaccine offers the most encouragement of all the therapeutic agents at hand.

The ability of an individual to combat a disease of bacterial causation, is dependent upon the amount of opsonin present in his blood. This can be estimated by an examination to determine the ability of the leukocytes to digest bacteria.

Opsonin Index.—The number of bacteria taken into the leukocytes in a normal healthy individual is taken as unity, or 100 per cent. In disease, the ability of leukocytes to digest bacteria grows less because the opsonic content grows less. For example, a normal healthy individual's blood will, when mixed with a suspension of tubercle bacilli, cause an average of about

nine bacteria to be taken up in each white cell. If we find a patient's blood to have so low an opsonic content that on an average only 4.5 bacteria were taken up in each white cell, we would express that patient as having an opsonic index of 50 per cent., or just one-half of the normal, 9. Frequently we find patients with so low an opsonic content in their blood that the average number of bacteria digested will be as low as .25. Obviously such a patient has a low fighting power.

Technique.—There are many complicated ones reported. The principles underlying them all are the ones originally laid down by Wright.

1. Take equal parts of the patient's serum and the bacteria whose index we wish to determine, and mix thoroughly.

2. Mix (1) with some white blood cells.

Mix the three thoroughly and incubate half an hour. Now make ordinary cover glass preparations, stain and examine to determine the number of bacteria digested in the leukocytes. Count fifty cells and determine the average.

The conclusions of White and Reed regarding the value of the opsonic index as a diagnostic measure in cases of tuberculosis or lupus are as follows:

(a) When a series of measurements of the opsonic index of the blood is persistently low, it may be inferred that the infection is tuberculous in character.

(b) Where repeated examination reveals a persistently normal opsonic index, the diagnosis of tuberculosis may with probability be excluded.

(c) Where there is revealed by a series of blood examinations, a constantly fluctuating opsonic index, the presence of active tuberculosis may be inferred.

The opsonic index is of great value in affording valuable information in the diagnosis, prognosis and treatment of bacterial diseases, and ranks with the brilliant work of Pasteur, Koch, Behring, and Major Walter Reed.

Heredity and Congenital Influences in Disease.—One cannot entirely grasp the theory of pathology without some under-

standing of heredity and congenital influence as factors in disease. The subject of osteosclerosis and its etiology can, in the light of the present, be explained by heredity, as demonstrated by Körner, Denker, and Bezold, while the gross lesion and macroscopical findings are better explained by Siebenmann.

Von Troeltsch first demonstrated the influence of heredity in the production of catarrhal deafness, and showed that inherited peculiarity of the anatomical structure of the ear, Eustachian tube and throat produced a narrowing of the tympanic cavity and Eustachian tube, and alteration about the vestibular windows, subsequently ending in chronic catarrh.

Many dyscrasias may, in the true sense of the word, be an inheritance and not a congenital condition. A dyscrasia is congenital when the disease, per se, is transmitted to the child through the placental circulation and probably the amniotic fluid.

The so-called catarrhal diathesis and tubercular disposition may be inherited dyscrasia, and hemophilia, lymphatic temperament, septal deformities, except those due to traumatism or disease, deafmutism, and many oral and laryngeal deformities can thus be explained as direct results of an inheritance.

Heredity and congenital influences, controlling an embryological development, are frequently hard to separate; for instance, in the so-called congenital laryngeal stridor, a condition occurring at birth and ending about the second year of life, it is sometimes difficult to differentiate congenital and inherited influences as etiological factors.

Disease probably cannot be inherited, and since disease cannot be transmitted to, or through the germ plasma of the parental sexual cell, dyscrasia and syphilis are the results of contamination of the fully developed embryological or fetal cell from the mother, by way of the placental circulation.

According to Martins, the parent can only transmit material substrata, which are rudiments in the germ plasma of the sexual cell. The substrata, or determining peculiarities of the parental germ cells are, according to Körner, who quotes Weissman, called determinants, and these determinants may not alone originate in the parental cell, but may be the result of transmission for one or more generations

back; in other words, a determinant may remain latent in the offspring, only to manifest itself in the offspring's progeny.

In the light of the foregoing statements, how can we explain the theory that a father can transmit syphilis to his offspring, and the mother show no symptoms of the disease. It is presumed that a mother bearing a syphilitic child can immunize herself from absorption of the serum or immunizing products from the syphilitic child in utero. It is quite reasonable to presume that the mother at some time was infected with syphilis and that it had remained latent in her system from a natural immunity, only to manifest itself in the child through the placental circulation.

Hyperemia is recognized as an increase of blood to a part, due to an irritation affecting the vaso-motor system. Hyperemia may be active or passive. In active hyperemia the mucous membrane of the nose and throat in place of being pale pink in color is bright red. This discoloration may be confined to one or both sides of the nose. If affecting the drum, there will be a mild blush confined to the periphery or extending over the entire drum. Active hyperemia may continue long enough to bring about a structural change in the vessel wall, the condition being considered, however, a temporary one, the blood vessels retracting with a complete return to the normal. There are seldom any conspicuous symptoms of active hyperemia. The patient may complain of a slight burning sensation in the nose or, if the internal ear is involved, tinnitus aurium with vertigo and nausea.

Closely allied to hyperemia, especially in the uvula and glottis, we frequently observe a sudden dilatation of the blood vessels with exudation of serum, producing a condition known as edema.

Active hyperemia may quickly pass into simple inflammation or end in spontaneous recovery. Among the exciting causes of hyperemia of the ear, nose and throat, are exposure to cold, irritating gases, dust, ingestion of full doses of quinin or the salicylates, alcoholic liquors, exanthematous diseases, indigestion, bacterial toxins and nervous disturbances.

In passive hyperemia there is a greater or less obstruction to the flow of blood through the veins. A very good example of passive

hyperemia is the hemorrhagic extravasation into the mucous membrane of the soft palate and faucial pillars, which sometimes follows removal of the tonsils.

Inflammation, as defined by Warren, is "a lesion in the mechanism of nutrition, owing to which its efficiency is impaired, but which, if not so severe as to cause death, produces conditions favorable for the protection and repair of the part." According to the rapidity and character of the lesion, inflammation may be acute or chronic.

Among the many causes of inflammation are heat, cold, trauma, chemical agents, ptomains, leucomains, toxins, toxalbumins and bacteria. These agents all act in a manner quite similar and are irritants to the tissues of the body. As a result of irritation an alteration is brought about in the supply of blood to the part, which if continued for any length of time, brings about a congestion of the internal organs with paralysis of the constriction fibers or a stimulation of the vaso-dilators of the peripheral blood vessels with a rapid flow of blood to the parts, followed by a slowing of the current and, as described by Cohenheim, an exudate of the elements of the blood stream by a process of leakage through the vessel wall with all the symptoms so well known of inflammation. The rôle of autotoxins and internal secretions in the causation of inflammation of the upper air passages is sufficiently understood, thanks to the researches of Sajous, Vaughn, Bouchard and others, to be classed as important agents. Certain bacteria produce toxalbumin and toxins which lower the vitality of a part. Ptomains, from the presence of non-pathogenic bacteria in dead animal matter, are evolved during disturbed digestion, and autotoxemias resulting from inherited or acquired diathesis, are conditions acting very much alike in a disturbance of the nutrition of the upper air passages. The effect of the toxin and toxalbumin is well shown in the direct relationship of acute gastro-intestinal disturbance and acute coryza.

The relation of the anterior and posterior pituitary bodies to the adrenal glands and the influence of the adrenal secretion upon the cellular metabolism is probably a great factor in causing many of the functional and organic changes which are constantly going on in the structure of the organs under consideration. According to Sajous,

"drugs, toxins, physiological toxalbumins, etc., stimulate the adrenal system when the proportion of these agents in the blood did not exceed a certain limit and that when this limit was exceeded, *i. e.*, when the dose administered or the amount of toxins secreted by the bacteria, etc., was excessive, it either inhibited or arrested the function of the system."

The adrenal secretions have a direct influence upon the quantity of the blood and blood plasma and cellular metabolism. If influences known and unknown are of sufficient potentiality to disturb the equal balance of the adrenal system, local or general pathological changes take place.

The treatment in the future will be closer attention to the character of the secretions from the nose and throat and chemistry of the internal secretions and their influence upon the mucous membrane of the upper air passages.

Since the discovery of the influence of bacteria in diseases, inflammations are subdivided into non-infective and infective.

With the constant presence of bacteria within the body it is very difficult to conceive of inflammation without the active or remote influence of bacteria.

Heat, cold, chemical agents, toxins which are classed by some as chemical substances, are non-infective agents.

Diseases that may be produced by non-infective agents are acute and chronic catarrh, osteosclerosis, arteriosclerosis, labyrinthitis, sinusitis, hypertrophy, edema and atrophy.

Infective agents are all known as pathogenic bacteria. The staphylococcus and streptococcus are the most frequent exciting causes of inflammation and suppuration of the upper air passages. Among the various diseases due to bacteria are croup, diphtheria, scarlet fever, measles, syphilis, tuberculosis, acute and chronic otitis media, suppurative otitis, septicemia, pyemia, malignant edema, furuncle, acute and chronic sinusitis.

According to the character of the lesion, inflammation is divided into parenchymatous, interstitial and exudative.

In the parenchymatous form of inflammation, according to Langerhans, the exudation is taken up by the cells of the organ. Active

changes in the blood vessels do not necessarily occur; sometimes ischemia from pressure of the swollen cells may occur. Changes of this character may be noted in enlarged tonsils.

In acute interstitial inflammation we have an acute suppurative change in the structure of an organ, sometimes thrown out upon the surface. Among the many examples of interstitial inflammation are peritonsillar abscess, abscess of the pharynx, and tonsillitis.

In chronic interstitial inflammation there is a proliferation of connective tissue cells, which finally ends in atrophy.

In the exudative form of inflammation we have, according to Langerhans, the following classification of the exudate:

1. *Mucous Exudation.*—Thrown out from the surfaces covered with cylindrical epithelium, classed as catarrhal exudation.

2. *Fibrous Exudation.*—Thrown out upon the surface in nose and throat, Eustachian tube and middle ear. Inflammation of the fibrous exudate, a coagulation may take place from croupous membrane. A diphtheritic membrane is formed by a coagulating necrosis of the exudation and tissue composing the mucous surface.

3. *Cellular Exudation.*—

(*a*) Epithelial cells: desquamative.

(*b*) Colorless blood corpuscles: purulent.

(*c*) Red blood corpuscles: hemorrhagic exudate.

4. *Ichorous Exudation.*

Immunity.—In a discussion of inflammation, the influence of bacteria, their proteid substances and toxalbumins have been mentioned. Since the discovery by Jenner of the prevention of smallpox by vaccination and later the researches by Pasteur in regards to fermentation, up to the present time with Behring's discovery of the serum for the mitigation of the severity of diphtheria and the prevention of the disease in immunized individuals, the subject of immunity has been of the greatest interest to physicians the world over.

The term immunity signifies a natural or acquired resistance against pathological bacteria or their products.

By natural immunity is meant a condition of resistance to pathogenic bacteria from the constant presence within the body of a chemical physiological substance, the absence of which is necessary for

the growth of microörganisms. Acquired immunity against one kind of bacteria results in two ways:

1. The injection of a small quantity of bacilli sufficient to cause a slight inflammatory reaction, one injection being all that is necessary to immunize the patient or animal. The time required for immunity to establish itself is one week.

2. From injection of the serum of the blood of the individual or animal immunized by the injection of the bacteria or their toxins.

The last is the method most frequently employed in immunization against such diseases as bubonic plague, dysentery, yellow fever, diphtheria, etc. By the injection of the antitoxin of diphtheria in a child exposed to diphtheria we bring about a condition of passive immunity, *i. e.*, an immunity limited in its duration. Active immunity follows an attack of certain diseases, as typhoid fever, variola, yellow fever, erysipelas. In active immunity we may have, as in passive, a limitation of the duration of the immunity.

Each organism must possess its own peculiar antidote: in other words, the streptococcus serum can have no influence on a disease produced by any other organism. The antitoxin of diphtheria will have no influence upon a throat affection due to streptococcus or staphylococcus infection. Immunizing serums are especially directed to the neutralization of toxins of bacteria within the body. Wasserman, of Berlin, has discovered a serum which has a direct influence upon the bacillus of diphtheria, killing the bacilli in loco. Sera acting directly upon the bacteria are known as bactericide sera, in counterdistinction to antitoxic sera, which only act on bacterial toxins. With the methods of Behring and Wasserman we can neutralize the chemical products of the bacilli of diphtheria, kill the source of the toxins, *i. e.*, the bacteria, and prevent greatly the spread of the disease.

Hypertrophy of a tissue or an organ is due to an increase in the size of the cells, caused by inflammation, excessive use, inherited conditions or vaso-motor disturbances.

Inflammation probably plays the most important part in causing hypertrophy of the mucous membrane of the ear, nose and throat.

Hyperplasia is understood to be an increase in the number of

cells in a given organ. The underlying cause is not unlikely the same as for hypertrophy. Hypertrophy and hyperplasia are closely allied. It is in the turbinated bodies that the two conditions are easily differentiated. The turbinated bodies are soft in hypertrophy and shrink approximately to the normal size under cocain or suprarenal extract, whereas in hyperplasia the turbinated bodies are firm to the touch and little or no shrinkage takes place under cocain or suprarenal extract.

Atrophy of an organ or tissue is a lessening in the size and thickness, with change of color and partial or complete loss of function, due to a decrease in the number of component cells. It is thought that atrophy is first preceded by hypertrophy. This metamorphosis is brought about by inherited dyscrasia, suppurative diseases in contiguous parts, old age, nutritive disturbances and operative measures by which the mucous membranes are unduly exposed to infection and irritation from extrinsic influences.

Tumors of the upper air passages are like those in any other portion of the body, and according to Ziegler, are a new formation of tissue, apparently arising and growing independently, having a typical structure, possessing no function of service to the body and showing no typical termination to their growth.

Tumors are more frequent in the nose and throat than in the ear. This is accounted for by the structure and position of the organs and their exposure to irritation and inflammation.

Tumors, with the exception of malignant growth, are, generally speaking, homologous structures, that is, they spring from like tissue and are hyperplasias of the normal tissue (Langerhans), surrounded by a limiting capsule. Tumors which deviate from the normal or mother tissue, are classed as heterologous and are usually malignant growths. Non-malignant tumors are so named because in their growth and structure they are not antagonistic to life, other than by interference with the function of an organ by pressure. They grow by a process of cell proliferation and have no tendency to distribute germ cells to other portions of the body by a process of metastasis. They have no tendency to recur after removal, even if a small part remains. They are somewhat self-limited in growth. Tumors

which deviate from the mother tissue are usually classed as heterologous or malignant. The greater this departure of the tumor cells from the tissue within which it originates the greater the malignancy and the dispòsition to metastatic formations. Those which are highly vascular are always the most malignant (Langerhans). Tumors of this character are prone to rapid recurrence, providing any of the diseased tissues are left in loco.

According to Virchow, from the anatomic-genetic standpoint, tumors are subdivided into three groups.

1. Extravasation and exudation tumors. Tumors of this character found in the organs under consideration are hematoma and cysts.

2. Dilation and retention tumors, *i. e.*, all tumors of a cystic character, which take place in a preëxisting space (Langerhans), are cysts of the thyro-glossus duct, mucous cysts of the antrum of Highmore, etc.

3. Proliferating tumors which are subdivided into: (*a*) Histoid tumors or those growing from connective tissue or the supporting framework and are fibroma, myxoma, osteoma, chondroma or enchondroma, sarcoma, neuroma or neurofibroma; (*b*) organoid tumors or those composed of both epithelium and connective tissue and classified as adenoma, cystoma and carcinoma; (*c*) teratoid or tumor-like formations occurring in tissue of unlike cellular structure. Tumors of this character are cholesteatoma, found in the middle ear and tonsils (Norval Pierce), hairy polypi of the nose or throat, and dermoid cysts of the *nose* and *auricle*. All tumors of the nose, throat and ear are, clinically speaking, neoplasms.

Etiology.—Non-malignant growths may result from traumatism, infection, trophic disturbances, malnutrition, irritation, metastasis and hematogenetic influence or any other condition which will produce an increased cell activity resulting in an atypical structure.

The exact etiology of malignant growths is still a disputed question. The following are some of the theories generally accepted:

1. Traumatism, irritation prolonged in character or chronic ulceration of the mucous membrane.

2. Cohenheim advocated many years ago the theory that certain embryonic cells foreign to the place in which they are found persisting without function in an organ or structure would, under favorable circumstances, develop into malignant growths; Cohenheim's theory of fetal inclusion, thus accounting for the presence of cells within any tissue different from that normally found there and their tendency to malignancy.

3. Kelling (*Munchener med. Wochenschrift*, June 14, 1904) lately advanced the theory of that certain embryological cells of different animals may be carried through the blood or deposited upon wounds by insects and carried into the tissue, where they proliferate and become malignant tumors. Kelling advances the theory in substantiation of the foregoing of specific precipitation by which tissue of different kinds could be differentiated by the use of the specific precipitations for blood. Tumor tissues were precipitated with the different serums. It was found that chicken serums produced the greatest amount of precipitation. From this result Kelling suggests a possible relationship between embryonic chicken cells and malignant growths.

4. As to the parasitic origin of cancer, as advocated by Steinhans, no absolute proof has been offered. A few investigators claim to have found in cancerous growths a protozoön which was presumed to exert an influence in causing the disease. Johannes Orth, probably the greatest authority on cancer, says that no one at the present time has produced proof that carcinoma is of parasitic origin, and that there is no necessity to presume such an etiology in carcinoma.

Malignant growths are subdivided into carcinoma and sarcoma. Sarcoma is composed of embryonic types of connective tissue which continues to grow independent of surrounding tissue, following, frequently, the course of the blood vessels. The varieties are large and small spindle-celled and giant-celled, all types of embryonic connective tissue. The intercellular substance is usually very scanty, the cells being clustered close together. Malignancy decreases with the increase of intercellular substance. Changes in the intercellular substance are frequently found, the tumors then becoming a mixture of the two, known as myxosarcoma or fibrosarcoma, etc.

The blood supply of tumors of the sarcomatous type is usually very profuse.

The small round-celled sarcomata are made up of small round cells with numerous blood vessels. There is very little intercellular substance (Fig. 47).

The large round-celled sarcomata differ from the former in size and increased amount of protoplasm in the cell. Between and

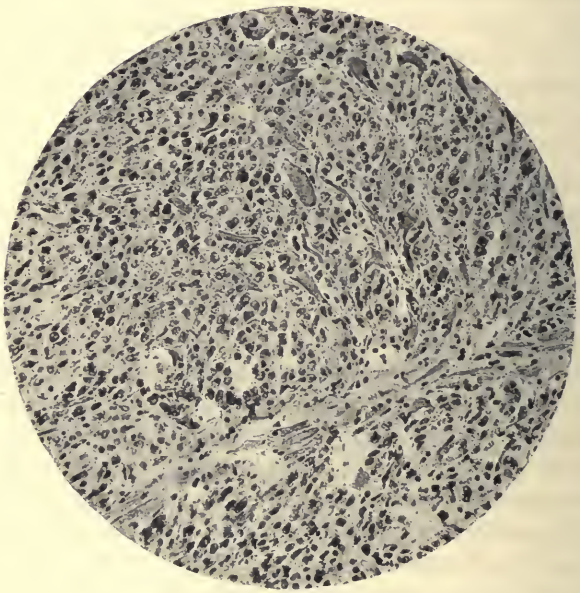

FIG. 47.—SMALL ROUND-CELLED SARCOMA. (After *Thayer.*)

surrounding the groups of cells are bands of connective tissue with blood vessels (Fig. 48).

The spindle-celled variety is most frequently observed. It is made up of long spindle-shaped cells with very little intercellular substance. In some cases, however, the amount of intercellular substance is very great and the tumor, taking on the character of the intercellular structure or gray substance, is then classified as

fibrosarcoma, myxosarcoma, angiosarcoma, lymphangiosarcoma and osteosarcoma (Fig. 49).

Sarcoma may spring from the connective tissue of the nose, nasopharynx, larynx, soft palate, tonsils, auditory nerve, inner, middle and external ear.

Carcinoma or cancer is a malignant tumor springing from

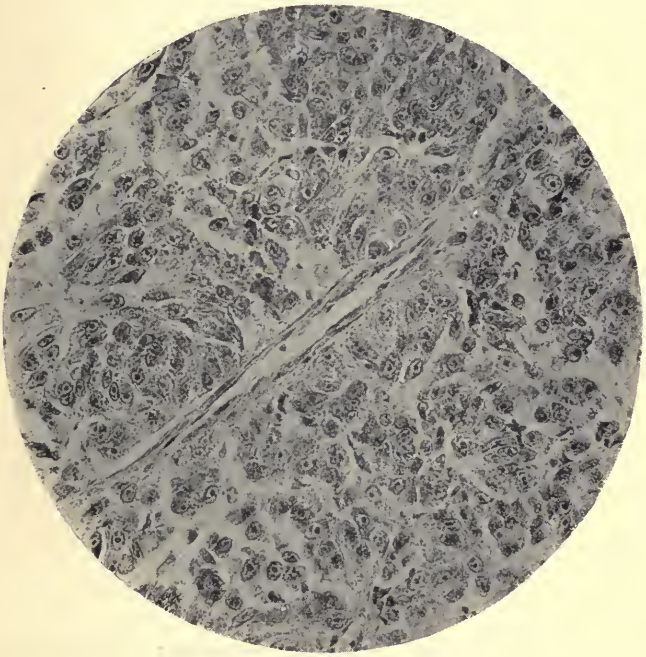

FIG. 48.—LARGE ROUND-CELLED SARCOMA. (After *Thayer.*)

epithelial structures and containing more or less connective tissue. The epithelial cells are atypical with a tendency to infiltrate by branching into typical structures. The growth proliferates and spreads more especially by way of the lymphatics, though remotely through the blood vessels.

The atypical cells are seen to be in close contact, appearing in

groups, surrounded by alveoli of connective tissue or glandular tissue, poorly supplied with blood vessels. Tumors of this character reproduce themselves wherever a small portion remains after operation for removal (Fig. 50).

Carcinomata, according to the character of the epithelium and the glandular structure, are classed as *flat-celled*, *cylindrical-celled*, *adenocarcinoma* and *carcinoma glandular solidum*.

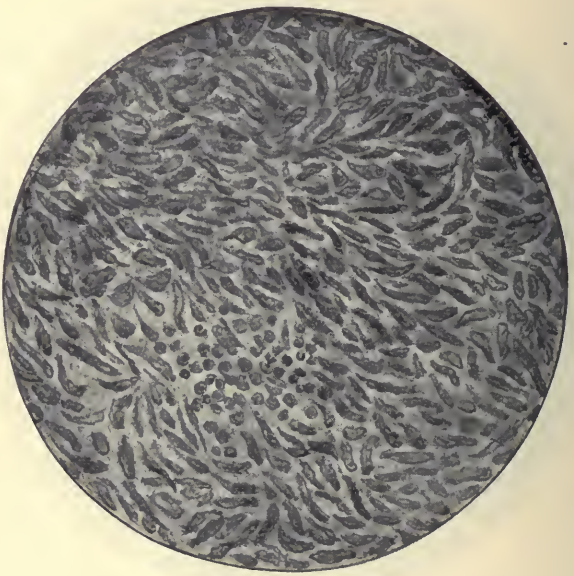

FIG. 49.—SPINDLE-CELLED SARCOMA.

Flat-celled carcinomata are commonly spoken of as epithelioma and involve those structures covered with flat or squamous ciliated epithelium and occur on the skin or junction of the skin and mucous membrane, mouth or alæ of the nose, pharynx, larynx and auricle.

Cylindrical-celled carcinomata develop from mucous membrane, covered with cylindrical epithelium as in the mucous membrane of the nasal cavity, accessory sinuses, naso-pharynx, tonsils, portions

of the larynx and the Eustachian tube. A squamous cell may change into a cylindrical cell and vice versa, thus a squamous-celled carcinoma may appear in a mucous surface covered with cylindrical cells.

Carcinomata usually appear late in life, differing in this respect from sarcoma, which occurs at any age.

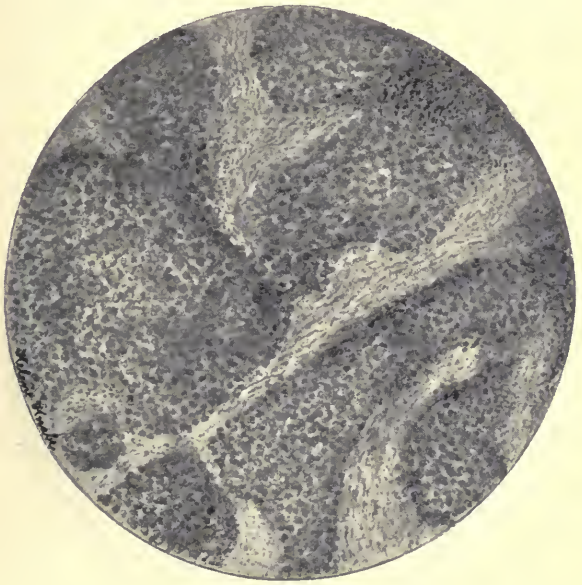

FIG. 50.—EPITHELIOMA OF THE NASO-PHARYNX.

Experimental inoculation shows that cancer may be transmitted among animals of the same species only. Dagonet claims to have transmitted an epithelioma from man to a rat, producing a like histologic structure.

Adenocarcinomata are tumors of glandular epithelium infiltrating the parent tissue. Histologically, the structures exhibit a parenchyma composed of polymorphous cells arranged in alveoli, which often anastomose widely and are separated by connective tissue stroma (Hektoen-Reisman).

Tumors of this character are found in the sebaceous glands of the auricle (Politzer) and the salivary glands.

Non-malignant tumors of the ear, nose and throat may be classified according to the ground substance from which the tumor springs, as fibroma, myxoma, lipoma, chondroma, osteoma and neuroma. A combination of two kinds of tissue tumors gives rise to fibroadenoma, neurofibroma, etc.

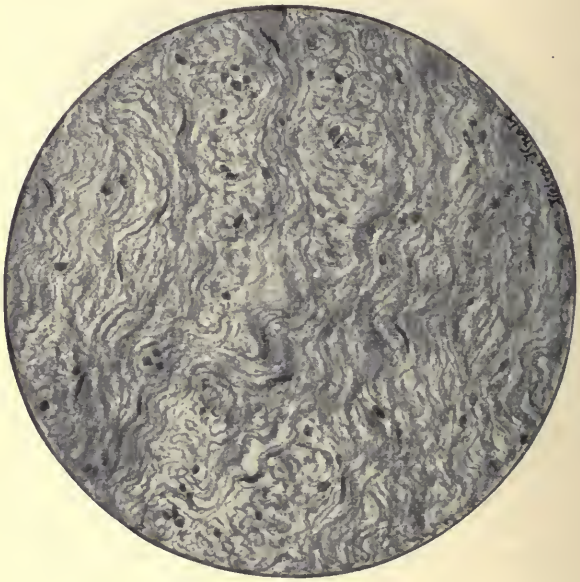

FIG. 51.—FIBROMA.

Fibromata are tumors consisting of ordinary connective tissue and may occur on the skin, mouth, nasal cavity, nasopharynx, larynx, tonsils, middle and internal ear (Fig. 51).

They sometimes undergo degeneration, breaking down with the formation of an ulcer.

Their blood supply varies: in cases observed by the author there was little hemorrhage upon their removal.

Tumors of this character have a broad base or may be somewhat pedunculated. As to their density, they may be soft or hard.

Myxomata or mucoid tumors are composed of mucous tissue, soft and jelly-like, containing mucin, springing from connective or mucous tissue.

If an increase of fibrous tissue occurs in the submucous structures, the tumors become more firm in consistency and are designated *myxoma fibrosum.* A familiar example of myxomata is a fibrous polypi of the nose.

Location of such tumors is usually in the superior or middle meatus of the nose. Suppuration of the accessory sinuses is classed as an exciting cause of myxomatous tumor. There is still a doubt in regard to the transposition of a myxomata into a malignant growth, though myxomata may be combined with either a sarcoma or a carcinoma.

Myxomata may be single or multiple, sessile or pedunculated (Fig. 52).

Under the microscope the tumors appear as myxomatous substance in a reticule of connective tissue with broken-down epithelium and other debris. Tumors of the myxomatous type may be found in the nose, accessory sinuses, larynx and external and middle ear.

In the middle ear the formation of these tumors is preceded by an acute or chronic purulent inflammation of the middle ear, with destruction of the drum.

Lipomata are described as lobulated growths of fat cells springing from connective tissue and are found more often beneath the skin of the auricle of the nose. The fat cells occur in groups surrounded by areolar tissue and differ in no wise from normal fat. They may spring from the arytenoepiglottic fold, as described by Bosworth. This author also mentions one case of lipoma of the larynx described by Burns. Theisen reports one case of lipoma springing from a crypt of the tonsil.

Chondromata are cartilaginous tumors and are subdivided into the hyperplastic and heteroplastic forms.

The hyperplastic are outgrowths from preëxisting cartilage found especially along the cartilaginous septum of the nose.

The heteroplastic or enchondromata are isolated patches of cartilaginous tissue, sometimes resulting from cartilaginous structures, which have failed to change into bone. They may develop from a non-cartilaginous matrix.

Chondromata occur more often in the ear, nose, larynx and trachea. Late in life chondromata have a tendency to calcify or ossify.

Osteomata are bone tumors developing from periosteum, bone

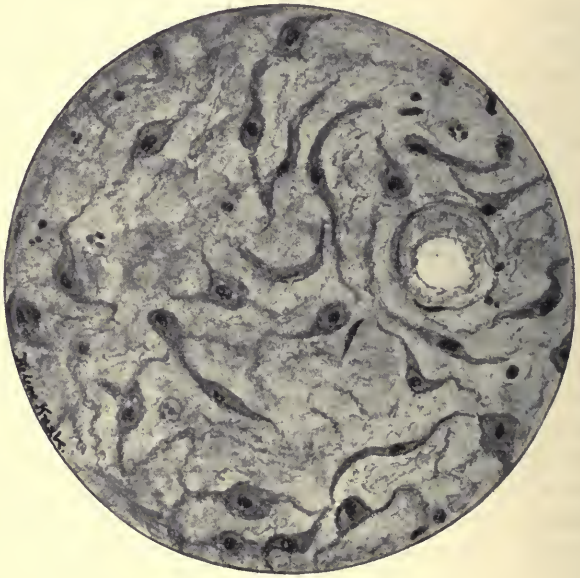

FIG. 52.—MYXOMA.

cartilage or other connective tissue. In histological structure they resemble true bone. They may become mixed with other connective tissue tumors forming osteofibroma or osteochondroma.

Two forms are recognized, hyperplastic and heteroplastic. Exostosis belongs to the former classification and is a growth from the surface of bone or cartilage. Heteroplastic are bone tumors in organs of other than bone or cartilaginous structure.

Osteomata may be found in the auditory canal, auricle, nasal cavity, accessory sinuses, larynx, pharynx and tonsils.

Hereditary disposition, trauma and syphilis are presumed to be important factors in the etiology of the disease.

Neuromata are tumors derived from nerve structures. Tumors of this character are usually mixed with fibrous tissue and are exceedingly rare. Fränkel and Hunt report (*Annals of Surgery*, 1904) an interesting case of neurofibroma of the acoustic nerve.

Cystomata, or cysto-adenomata, begin usually as an adenoma whose glands become cystic from accumulation of fluid. They may have an epithelial origin. The writer recalls a case of supposed cystoma of the larynx in a man of forty years of age. Upon laryngeal examination and spasm of the throat, the tumor round, bluish in color and about the size of a guinea egg, would spring into view, completely filling the laryngo-pharynx. Dr. G. V. Woolen, of Indianapolis, removed the tumor and found its pedicle attached to the posterior wall of the cricoid cartilage.

Adenomata are tumors composed of glandular tissue situated within the glands or mucous membrane. Tumors of this character are very closely allied to carcinomata.

According to Ziegler, "the chief characteristic of the adenoma is the formation of new glands which depart more or less from the typical glands of the affected organ." They may be observed in the sebaceous glands of the nose and ceruminous glands of the auricle or springing from the mucous glands of the nose and mucous polypi, as first discovered by Billroth.

Angiomata are tumors composed of new-formed blood vessels. They may occur in the skin or subcutaneous tissue and appear as circumscribed elevations or a diffused infiltration within the subcutaneous tissue. They are very often infiltrated with connective tissue leading to the formation of angiofibroma. It is probable that angiomats develop from dilation and diffusing of arterial or venous capillaries. To the eye, hemangiomata appear as red or dark bluish infiltrations.

"Mother marks," or nevi, belong to one of the classifications of angioma. Deep or light reddish, congenital discoloration of the ear,

nose or mucous membrane of the pharyngeal pillars, characterize the affection.

Cavernous angiomata are usually acquired conditions and are vascular tumors formed by the conversion of thickened mucous or submucous tissue into cavernous tissue by the dilation of venous capillaries. Tumors of this character are dangerous to life from accidental rupture.

Papillomata are epithelial tumors appearing on the skin or mucous surface.

These tumors are made up of epithelial cells, which proliterate from a localized area, appearing as wart-like excrescences, singly or in numbers.

The character of the epithelium composing the tumors varies according to the location. The color and density of the tumors is dependent upon the amount of connective tissue present and its blood supply.

Papillomata may be either soft or hard. The former is found in the middle ear, nose, mouth, pharynx and larynx and are usually covered with cylindrical cells. Tumors of this character may be sessile or pedunculated, and may occur at any age.

On account of the diffuse blood supply in the soft variety, bleeding is a very frequent complication.

CHAPTER VII.

METHODS OF EXAMINATION OF THE NOSE, THROAT AND EAR.

BEFORE beginning the examination of a patient a record should be made of the name, address, history and subjective symptoms. For this a card system (see page 104), simple in character, is greatly in favor.

Following the examination a complete history should be recorded, with diagnosis, treatment, and drawing of any microscopical lesions.

A satisfactory technique is necessary in the examination of the ear, nose and throat. Manuel Garcia, well named the Father of Laryngoscopy, designed a mirror in 1854 for the observation of the larnyx.

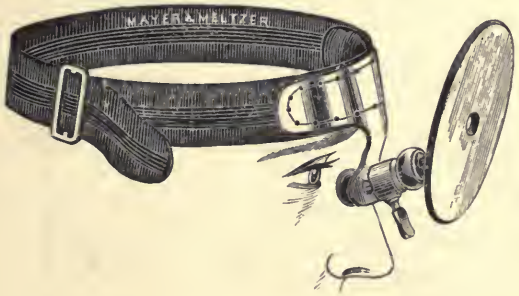

FIG. 53.—HEAD-MIRROR AND BAND.

About 1858 Czermak improved upon the method of Garcia, substituting artificial for natural light. This was reflected into the larynx by an ordinary ophthalmoscope. It was but a short step from the plan of the ophthalmoscope to the head-mirror, which is in universal use to-day for the illumination of the ear, nose and throat (Fig. 53).

190 M AGE ADDRESS

DIAG. OCCUP. FROM DR.

HISTORY

DURATION R.
- IMPAIRED HEARING
- TINNITUS
- DISCHARGE
- PAIN
- VERTIGO

DURATION L.
- IMPAIRED HEARING
- TINNITUS
- DISCHARGE
- PAIN
- VERTIGO

CAUSATION

HEREDITY DIATHESIS PARCUSIS

	Watch	Ac'mtr.	Whisper	Speech	Ac c	C1	C2	C3	C4	Bc C	C2	C4	Rinne	Webber	Galton
Before R.															
" L.															
After R.															
" L.															

RETINOSCOPY (DONIVAN.)

PHARY & LARYNX

The ordinary head-mirror is round and concave, two and one-half to three inches in diameter, with a central opening. A great variety of head-bands can be had, designed to suit the needs of all.

The electric head-mirror, on account of the amount of heat generated, is unsatisfactory for prolonged examination or treatment of patients.

McKenzie's light condenser, with mirror attached to a slender rod, is preferred by many (Fig. 54) to the ordinary head-band.

Quality of light in illumination, whether it be direct or indirect, is the first essential to an accurate observation. The direct light from the sun's rays, on account of its uncertainty, is of little practical value,

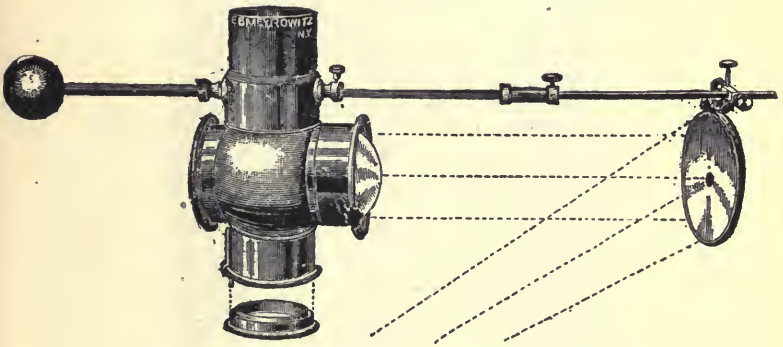

FIG. 54.—MCKENZIE'S LIGHT CONDENSER AND REFLECTOR.

while artificial light with room darkened is the most satisfactory method of illumination. The Welsbach burner probably furnishes as satisfactory light as any other. We should aim to secure as near a white light as possible.

Electric laryngological lamps can be had through any instrument house. They are so constructed that reflection of a solid, white center takes the place of the reflection of the filament, which destroys the usefulness of the ordinary electric lamp.

For those intending to engage in special work, the Clark and Roberts' chair is comfortable to the patient and is so constructed that the operator can elevate, lower or swing the patient to the right

or left with ease. In examination of the nose and throat, the light should be slightly behind and on a line with the patient's ear, to the right or left side, according to the custom of the operator. The head of the patient should be on a line with the perfectly erect body,

FIG. 55.—CLARK AND ROBERTS' TREATMENT CHAIR.

facing the operator. Following the examination of the nose and throat, by revolving the chair, the ear can be examined without necessitating a change in the position of the operator.

In examination of the anterior nares a great number of specula

are available, that designed by Myles, self-restraining, and Pynchon (Figs. 56 and 57) are quite as satisfactory as any others. The tongue depressor, designed by Andrews and modified by Pynchon (Fig. 58), on account of the width of its blade at its extremity and the shortness of the handle, which enables the operator to rest the point of the index

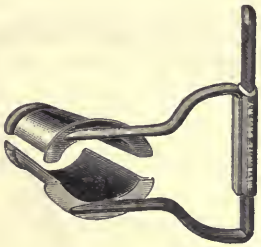

FIG. 56.—MYLES' NASAL SPECULUM.

finger against the chin of the patient, gives a double advantage in depressing the tongue in obstinate cases.

The rhinoscopic mirror of Fränkel is so constructed that the small mirror can be pushed behind the soft palate on a line with the tongue and when in position, elevated at an angle sufficient to bring into view the whole of the post-nasal space. By this method we detect the size of the posterior hypertrophies, adenoids, and tumors, and the

FIG. 57.—PYNCHON'S NASAL SPECULUM.

condition of the meatus, the Eustachian tube, floor of the posterior nares, uvula and tonsils. In passing the mirror into the posterior nares or pharyngeal space, on account of the tendency to cause retching, care should be taken to prevent touching any part of the throat.

In examination of the pharynx our attention should be directed to the lips, teeth, roof of the mouth, condition of the tongue and oral mucous membrane, tonsils in their outer, inner and upper aspect,

post-nasal space and pharyngeal wall. It frequently occurs that the muscles of the soft palate are in a condition of involuntary contraction procluding posterior rhinoscopy. Under such circumstances a four per cent. solution of cocain should be applied about the soft palate and uvula. If this is not sufficient to control the spasm, a

FIG. 58.—ANDREWS-PYNCHON TONGUE DEPRESSOR.

palate retractor, preferably a White, may be used (Fig. 59). The curved hook of this instrument is passed behind the soft palate, after which the anterior wire loops are pushed backwards until they are in contact with the floor of the meatus of the nose. By making gentle friction on the stem of the instrument the uvula is brought forward.

FIG. 59.—WHITE'S PALATE RETRACTOR.

By turning a small screw in the base of the anterior loop the stem is fixed in position.

For the satisfactory differentiation of morbid growths in the post-nasal space, tongue and tonsils, it is frequently necessary to use the finger. With the mouth gag in position, the finger, with palm upward, can be quickly passed behind the soft palate and into the post-

nasal space. In the examination of tongue or tonsils the index finger of the right or left hand many be used. If examining with the right index finger, the operator stands behind and to the right of the patient, at the same time passing the left arm around the patient's head, supporting the mouth gag in position, or pressing the thumb deep into the cheek of the child, thus forcing the jaws open. If the child is tractable, the finger is easily passed into the throat or post-nasal space. In intractable cases, some difficulty may be experienced. In adenoid cases in children, upon removal, the finger is tinged with blood. The surgeon must always exercise precautions against being bitten by the child.

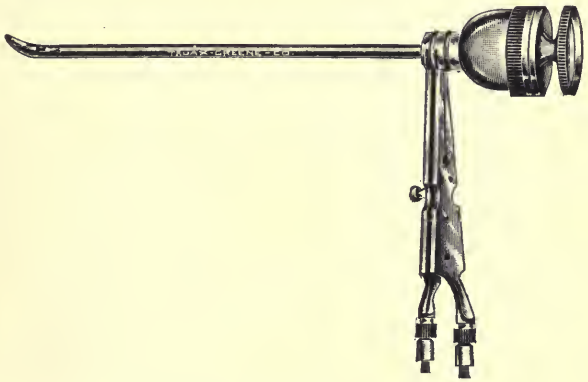

FIG. 60.—BECK'S SALPINGOSCOPE.

Salpingoscopy is a term given by Valentine to the method of examination of the ostium of the Eustachian tube by a salpingoscope, which is a modification of the cystoscope. The technique of the examination, according to Joseph C. Beck, is as follows (Fig. 60):

"Place your eye to the eye piece and make contact by turning on the switch and you will find, if the button (white) is situated toward the lateral side, you will see the vicinity of the tube illuminated and by moving the instrument gently forward and back, you will get the outline of the ostium tuba with its anterior and posterior lips and the dark shadow of the opening. It must not be forgotten that we are looking through a prism, therefore the object is inverted or, rather,

an inverted image. Also, that parts situated near the prism appear very large while those away, extremely small, as Valentine shows in his picture, that is, the velum of the palate very large and the larynx miniature-small. However, the lateral wall of the post-nasal space which we are now examining is not markedly changed in size, because its distance is about medium from the prism. One may examine both openings of the tubes through one nostril; however, as said above, one will look very much smaller than the other. Cocain is not necessary any more than passing a catheter, that is, in extremely irritable, hypersensitive subjects."

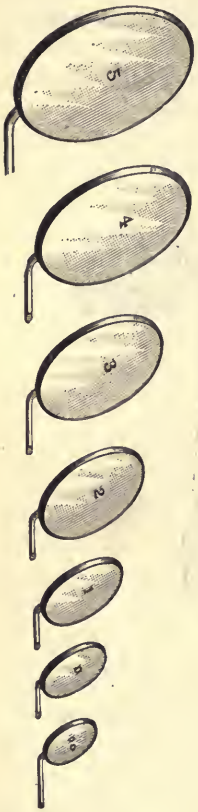

FIG. 61.—FERGUSON'S BOILABLE THROAT MIRRORS.

The method of examination of the larynx is known as laryngoscopy. For this it is necessary that one of the mirrors as shown in the illustration be selected (Fig. 61). The size necessarily varies in individuals. The one most frequently used is No. 5. The larger the mirror the more satisfactory the image. With the mouth wide open the protruding tongue should be grasped between the thumb and index finger, covered with a napkin. Care should be taken to avoid too much traction for fear of injuring the frenum of the tongue. In this position, the mirror is passed into the oral cavity, backward until it strikes the base of the uvula, which is pressed slightly upward and backward as the occasion may demand. By having the patient repeat the letter "ā" the larynx is lifted upward and exposed to view. In a few cases, the base of the tongue may obstruct the view; to obviate this, Kirstein designed a special tongue depressor. The spasm of the pharynx, which sometimes prevents the immediate exposure of the larynx, may be often overcome by temporarily holding the tongue for a few seconds before trying to insert the mirror.

It this process is unsatisfactory the throat and naso-pharynx should be sprayed with a four per cent. solution of cocain. The beginner will find some difficulty in learning the art of laryngoscopy. It is only with patient efforts that obstacles can be overcome.

The art of direct examination of the larynx is known as autoscopy, first described by Kirstein, of Berlin, in 1895 (Fig. 62).

In the method of examination as recommended by Kirstein,

FIG. 62.—AUTOSCOPY.

the physician stands in front of the patient. The patient seated, bends slightly forward and elevates the chin, bringing the neck and mouth on a line drawn through the larynx. The autoscope is grasped with the left hand and passed directly into the mouth. The spatula is directed backward and downward until the "tip catches in the groove between the tongue and epiglottis." The handle is elevated, bringing the hood in contact with the teeth.

The electric light should be turned on before the instrument is introduced, so that the mouth and larynx are under direct observation. The autoscope may be used in the direct removal of morbid growths, foreign bodies accidentally sucked into the larynx and direct medication. A variety of instruments are recommended by Kirstein for autoscopic operations.

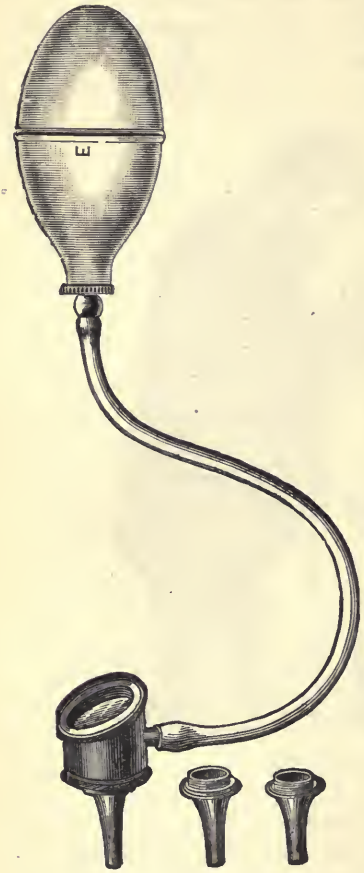

Fig. 63.—Siegle's Otoscope

In the examination of the ear the same rule in regard to illumination and head-mirror is applicable as in examination of the nose and throat.

After a complete history of subjective symptoms has been recorded, the external ear should first be recorded, followed by inspection of the meatus, auditory canal and membrana tympani. In the negro the canal is unusually straight and large. By lifting the pinna and retracting the tragus the entire canal is exposed. In the Caucasian, however, the examination is more difficult on account of the hair about the meatus and curve of the canal. To obviate this and to aid in inspection of the ordinary canal, a variety of ear specula have been devised. That designed by Boucheron has many advantages over those designed by Gruber, Toynbee and others. They should be made of silver and sterilized before being used.

For the estimation of the mobility of the drum the Siegle pneumatic otoscope is of practical value (Fig. 63).

For the determination of the mobility of the ossicles and membrana tympani, Siegle's pneumatic speculum is employed. The speculum is made of plated metal or hard rubber, covered by a thin plate of glass at its wide extremity. For this a nipple projects over which a soft rubber tube connects with a small rubber tube in turn connected with a small rubber bulb. The speculum should be covered with a small piece of rubber tubing, which should be moistened before being inserted into the ear. With the light from a forehead mirror carefully adjusted and the speculum in position, by a gentle compression and relaxation of the hand bulb, the movements of the membrana tympani and malleus can be observed.

In the examination and treatment of the Eustachian tube, a

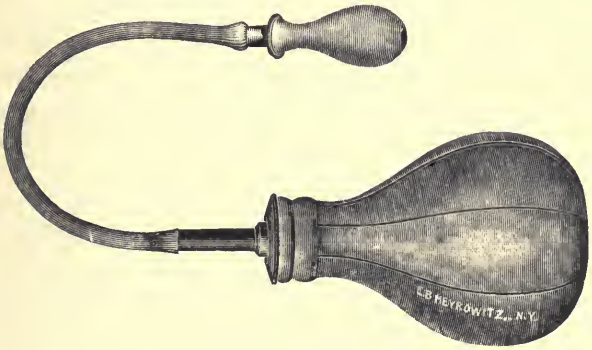

FIG. 64.—POLITZER BAG.

German silver catheter is necessary. Four sizes are to be had, numbers two and three being more often used. The curve may be altered to suit individual cases. It will be noticed that the ostium tuba varies in its position and size. The transverse diameter of the pharynx is not always the same and in consequence, the amount of curvature of the cannula will vary in individuals.

The nasal cavity should be sprayed with a one per cent. solution of cocain before attempting to pass the catheter. A few operators pass the catheter without the use of cocain. In the use of all instruments about the ear, nose and throat it is a very good rule to remem-

ber that the confidence of the patient and willingness to carry out the physician's instructions depend to a great extent upon the minimum amount of pain caused at each treatment.

The catheter can be dipped in boiling water, pure alcohol or carbolic acid for sterilization and should be oiled and any debris dislodged by forcing the air through it before any attempt is made at catheterization.

Politzer, Gruber and Lowenburg have laid down respective methods for the introduction of the catheter. In the Politzer method the catheter is held in the right hand, the curved tip pointing downward and inward. It is quickly passed along the floor of the nose until it reaches the posterior wall of the naso-pharynx and is then brought slightly forward and turned outward, again carried forward across Rosenmüller's fossæ, when it is turned outward and upward into the mouth of the Eustachian tube.

In the Gruber method the tube is passed quickly backward until it strikes the naso-pharynx. It is then rotated to the septum and brought forward until it strikes the soft palate, when it is turned outward and passed into the Eustachian tube.

The Lowenburg method resembles the method of Gruber in that the catheter, after reaching the wall of the naso-pharynx, is turned on its axis and brought forward until it strikes the posterior end of the septum, when it is rotated downward and outward into the tubal opening.

In addition to the catheter, the soft rubber Politzer bag of six to eight ounces should be provided with a soft rubber tube twenty-five to thirty inches in length joined to a hard rubber tip which fits the catheter.

The auscultation tube of Toynbee (Fig. 65) should always be used in inflating the Eustachian tube and middle ear. One end may be placed in the ear to be catheterized and the other in the physician's ear. Only by this method can we tell absolutely when the catheter is in position or the character of the sound produced by inflation. A wide blowing sound is an indication of an open tube. A high pitched sound is suggestive of a constriction in the tube. A whistling sound suggests a perforation of the drum. The absence

of sound indicates the catheter is not in position or that the Eustachian tube is completely closed.

The Politzer method of inflating the middle ear consists in placing the tip of the bag in the anterior nares after giving the patient a small swallow of water with instructions to hold the lips tightly closed until instructed to swallow. At the count of three the patient should swallow; at the same time, with the opposite side of the nose closed, the physician makes a quick pressure upon the bag, forcing the air into the middle ear. In swallowing, the tensor palate is relaxed, which opens the Eustachian tube. Gruber suggests that instead

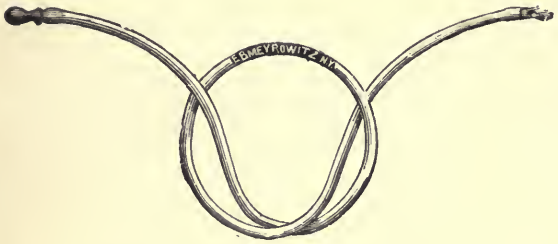

FIG. 65.—TOYNBEE'S DIAGNOSTIC TUBE.

of using water, the child should be instructed to say "hick" or "hack." The letter "k" may also be spoken. Sometimes by puffing out the lips air may be forced into the nose and then into the middle ear. For the last method the Pynchon small inflator may be attached to the spray cut off and used with more ease and success than with the Politzer bag.

Deformities of the nasal fossa or morbid growths may so obstruct the canal as to prevent the introduction of a catheter. Small obstacles may frequently be passed if care is taken to gently find a new direction. Deformities of this character demand surgical measures for their removal.

Tests of Hearing.—Sonorous vibrations reach the auditory nerve at its termination in the labyrinth by way of the auditory canal, the Eustachian tube and through the bones of the head. For detecting the amount of hearing power by each of the channels enumerated, the following tests are recommended:

Whisper Test.—Unless the examiner exercises great care in the choice of words, letters, numerals, pitch of voice, room and position of patient, results will be very inaccurate in this method. It is best for the examiner, from repeated tests upon normal ears, to establish a fixed distance for recording tests of this character. Variations in this position will be eagerly watched by the patient. The patient should be placed at a certain distance with the eyes bandaged.

Many years ago Oscar Wolf gave to the world his investigations of the voice as a test of hearing. The letter "R" is taken as the lowest in the scale, having one hundred and twenty-eight vibrations per second, and the letter "S" as the highest number of vibrations, having from five thousand, four hundred to ten thousand, eight hundred and forty vibrations per second. "Thus may be tested from the lower to two octaves of the higher musical tones." Thus in disease of the middle ear or auditory canal, those letters of low number of vibrations will be lost, while in labyrinthian disease low vibrations will be heard and high vibrations lost. The voice test should be used only with residual air.

Watch Test.—Like the voice, this test is subject to inaccuracy. The ordinary watch test is heard from thirty to forty inches. As in the voice and tuning fork, it must be remembered, those of high pitch are best heard when there is middle ear disease and low pitch when there are labyrinthian complications. Two watches are used, one with high pitched ticker and the other low pitched.

In recording this test the normal distance is taken as denominator and the distance at which the watch is heard as the numerator, thus, if heard at fifteen inches, the record should read 15/40, if upon contact only, watch C/40. The watch may also be applied to the mastoid or malar bone. Loss of bone conduction suggests internal ear disease. It must be remembered that secretions in the middle ear or temporary loss of tension may partially destroy bone conduction. Under such conditions the middle ear should be inflated and watch reapplied and if bone conduction is still lost other tests may be applied for the detection of the trouble.

Tuning Fork Test.—The Hartmann set of five tuning forks, C, C–1, C–2, C–3, C–4, varying in size from one hundred twenty-five

to two thousand forty-eight vibrations per second, are more often used in making the Weber and Rinne tests (Fig. 66).

For making a complete test, in addition to the Hartmann set of tuning forks, the Bezold-Edelman set of forks and whistles with a range from sixteen to forty-eight thousand vibrations, the normal range of hearing for individuals under fifty years of age, is the best.

The ends of the fork should be provided with movable clamps to prevent overtones and to govern the pitch of the instrument.

In the *Weber Test*, the tuning fork, preferably 256 V, is placed in the median line of the skull. If there is disease of one or both ears

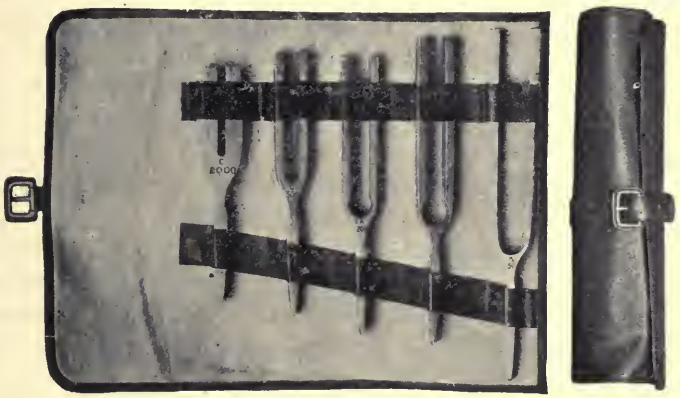

FIG. 66.—RANDALL'S CLINICAL SET OF TUNING FORKS.

involving the Eustachian tube, middle ear or stoppage of the external auditory canal, the tuning fork will be heard loudest on the diseased side; if one side only is diseased vibrations will alone be heard on that side. If the vibrations are heard only on the side of the good ear, disease of the labyrinth is indicated. Where we have diseases of both the middle ear and labyrinth we have two opposing conditions. The test is not so reliable in bilateral as in unilateral deafness.

In the classical *Rinne Test*, introduced by Rinne, of Prague, in 1855, we discover the relative hearing power by bone and air conduction. In the normal ear the vibrations of the air are heard from

fifteen to twenty seconds longer than through the mastoid. In the use of this test the position of the tuning fork, 256 V, upon the mastoid and movements of the fork to the auditory canal must be considered, likewise the age of the patient, as bone conduction is slightly diminished in those over sixty years of age.

This test is of such practical importance and is so little understood by the student that an effort will be made to simplify it, stating the proposition so that it may be practically applied.

This test is formed by placing the fork upon the mastoid, noting the length of time vibrations are heard and then quickly transferring before the ear and noting the revival of vibrations and length of time.

If the vibrations last for fifteen to twenty seconds we register "Rinne normal." If, say five seconds, we register "Rinne + (positive) 5." If the vibrations are not heard through the air, we register "Rinne — (negative)."

Advisedly speaking, diagnostic signs of this character are not infallible. By this knowledge and inductive reasoning we arrive at a clear understanding of the character of the disease.

The following proposition is a modification of the one set forth by Dundas Grant and will possibly give the student a clear conception of the application and value of the test. It is to be remembered that the Rinne test gives more accurate knowledge of the sound-conducting apparatus than the perceiving apparatus.

AC = Air conduction.

BC = Bone conduction.

AOD = Aero-osseal difference, or 20″ (20 seconds).

NAOD = Normal aero-osseal difference.

AC = *BC* (bone conduction) + 20″.

NAOD = 20″. Rinne positive, *i. e.*, conducting apparatus normal.

NAOD — 10″ = Rinne positive but shortened, conductive apparatus is one-half affected.

NAOD — 20″ = 0. Rinne negative, the conductive apparatus considerably affected.

NAOD — *BC* = Disease of the perceiving apparatus.

NAOD — (*BC* + 10″) = Partial disease of the perceiving apparatus.

$NAOD - (BC + 10'') - (AC + 10'')$ = Disease of perceiving apparatus.

In the test recommended by Gardner Brown, the tuning fork is applied to the bridge of the nose; if the vibrations cannot be heard as long by the patient as by the finger of the operator, there is loss of bone conduction. In this method, the finger of the operator must be trained to the test.

An acoumeter was devised by Politzer for examining the relative hearing distance. It is an instrument tuned to a certain pitch with no variations in intensity. It is supposed to be heard at forty feet, which number is taken as the denominator in recording the test.

Schwabach Test.—This test is made by ascertaining the number of seconds the fork is heard upon the mastoid and through the air and comparing with the normal register of the fork. Thus an increase of bone conduction over the normal, would indicate disease of the conducting apparatus; below the normal, disease of the perceiving apparatus. When both air and bone conduction are below the normal, there is probable disease of both middle ear and labyrinth.

Gelle Test.—In this test the air in the external auditory canal is compressed and the fork placed upon the vertex.

In the normal ear, the vibrations are diminished. If there is ankylosis of the foot plate, according to Gelle, there will be no change in vibrations. If labyrinthian disease is present, there is marked diminution of vibration with each compression.

Bing Test.—"This test is also used to differentiate between middle ear and labyrinthian affection. This experiment is based upon the fact that when the tuning fork ceases to be heard upon the mastoid it is heard anew when the external meatus is closed with the finger. In cases with pronounced deafness, if closing the meatus does not develop the tone anew, it is, according to Bing, a sign of middle ear disease, whereas, if it is heard again (in cases of pronounced deafness), it is a sign of labyrinthian disease" (Ballenger).

2. "This test is thus referred to for the sake of convenience in reference and refers to what Bing calls the 'entotic' use of the speaking tube. The purpose of the test is to differentiate between ankylosis of the foot plate of the stapes and adhesive bands or other

pathological conditions which hinder the malleus and incus in transmitting sound waves. The test is made by comparing the hearing of the patient through a speaking tube applied to the Eustachian tube by means of a suitable attachment fitting into the Eustachian catheter. If the patient hears better through the speaking tube by way of the catheter than he does through the external meatus, the inference is that the foot plate is freely movable while the malleus and incus are fixed or hindered in their vibrations. If such is the case, a rational sort of treatment is at once suggested, *i. e.*, either the freeing of the malleus and incus from the adhesions or other hindrances or removing one or both, perhaps preferably only the incus. The sound waves might then reach the foot plate through the vibration of the air in the tympanic cavity and hearing be materially improved" (Ballenger).

Galton Whistle.—With this instrument, which acts as a closed organ pipe, the vibrations from sixteen to forty thousand per

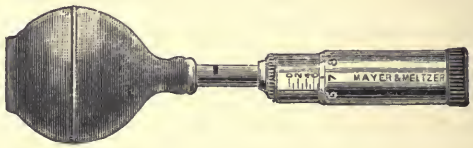

FIG. 67.—GALTON'S WHISTLE.

second are produced. With it relative tests for high or low tones are registered (Fig. 67). If the high notes are detected and the low notes lost, it is suggestive of middle ear complications. If high notes are lost and low notes detected, disease of the internal ear is probable.

König's Rods.—König's rods consist of a series of small steel cylinders of various lengths. With this method, the upper tone limit is more accurately determined.

CHAPTER VIII.

SPECIAL INSTRUMENTS AND THERAPY.

In the home treatment of the upper air passages, hand atomizers are in universal use. Many of these are badly constructed and, in consequence, patients complain greatly at the inconvenience occasioned by their getting out of order.

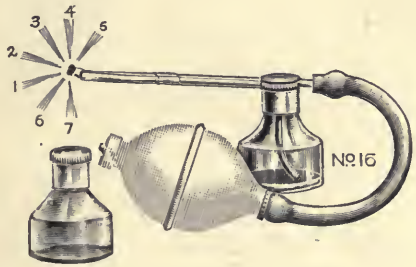

Fig. 68.—De Vilbiss Atomizer.

The hand atomizer of De Vilbiss (Fig. 68) is of metal and is easily taken apart and cleaned. The tip of this spray can be adjusted to any direction, a great advantage in spraying the laryngo-pharynx.

The form of atomizers for office use are those known as the Davidson, De Vilbiss and Sass (Fig. 69).

Cylinders for compressed air should possess an air meter so that the air pressure injected into the nose and throat can be modified to the individual demand. The methods followed by many practitioners of trying to regulate the pressure by the cut-off is unsatisfactory and unscientific. The air supplied to the cylinder is usually through hydraulic or hand pumps, though many offices are now supplied with air pumped from a central station. Under such

circumstances the pressure is so strong that it can be controlled only by cylinder and air meter.

Air filters, as recommended by Otto J. Stein, are especially recom-

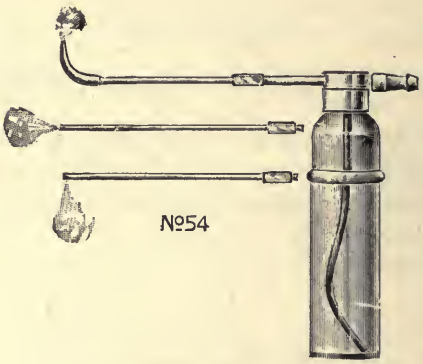

Fig. 69.—De Vilbiss Atomizer.

mended to prevent dust and water from reaching air cylinder (Fig. 70).

The Davidson hard-rubber sprays for cleaning are in universal use. For cleansing the post-nasal space, the post-nasal tip is of great advantage. By this method, the stream is thrown in a fan shape, spreading out over the entire fossa. The tip being large, it is more easily passed behind the palate, acting, if necessary, as a retractor.

The hand nebulizer offers the advantage of cheapness over the multiple nebulizer. One or the other is indispensable in the medication of the middle ear. By this method of treatment, medicines two or three times stronger than those used in the ordinary spray can be forced to points where fluids cannot.

A heater of value for keeping solutions at a uniform temperature is one designed by L. C. Cline. The source of heat is a small electric light globe. Warm fluids injected into the nose and throat are more quickly absorbed and less likely to irritate.

The **fountain cuspidor,** as illustrated (Fig. 71), is the ideal way

of disposing of fluids and excrementitious matter from the nose and throat. Those who do not take advantage of this method in the treatment of the nose and throat more often use a large porcelain bowl or small cup.

FIG. 70.—STEIN'S AIR FILTER.

For the refuse of cotton, a wide, deep receptacle is far preferable to the small metal ones.

Ear basins may be of papier-mache, hard rubber, glass or porcelain. Those of hard rubber are very light, while those of porcelain have

the advantage over the others in that they are not easily broken and do not lose their shape if left in boiling water, as do those of hard rubber or mache.

In using the hand atomizer (Fig. 68), the patient should be in-

Fig. 71.—Fountain Cuspidor.

structed to hold the atomizer directly in front of the face, the tube of the atomizer being on a line with the long axis of the nose. The spray tip should be inserted within the vestibule of the nose, at the same time gently lifting the end of the nose. Care should be taken

that the tube is not turned to the right or left, for by so doing, injury is caused to the mucous membrane covering the septum or turbinated bodies by the force of the spray. Bleeding frequently occurs from faulty direction of the spray tube, followed by mild infection. It is nearly impossible for the patient to cleanse the attic of the nose with a hand atomizer. There is a distinct advantage gained by the use of the atomizer, in that the solutions are absorbed and have a direct influence upon the inflammation and exudation.

The aqueous solutions frequently prescribed for home treatment for cleansing, are all mildly astringent and antiseptic and are as follows:

(1) ℞ Sodii bicarb., } āā 4.00 gm. (ʒ i)
Sodii bibor., }
Phenol (crysts), 1.00 c.c. (gtt. xv)
Glycerini, 30.00 c.c. (ʒ i)
Aquæ, ad q. s.
M.
Signa. (For Dobell's solution.) Add to quart of water and
Aquæ, ad q. s. 120.00 c.c. (ʒ iv)

(2) ℞ Glycero-thymol, 120.00 c.c. (ʒ iv)
Signa. Add one teaspoonful to four tablespoonfuls of water and use in atomizer.

(3) ℞ Sodii bicarb., } āā 60.00 gm. (ʒ ii)
Sodii bibor., }
Sol. antiseptici (lister), 240.00 c.c. (ʒ viii)
Glycerini, 750.00 c.c. (ʒ xxiv)
Aquæ, (O xxiv)
Signa. For Pynchon solution.

℞ Zinci sulph., .18 gm. (gr. iii)
Glycerini, 2.00 c.c. (gtt. xxx)
Aquæ, 30.00 c.c. (ʒ i)

℞ Phenol, } āā .30 gm. (gr. v)
Zinci phenolsulphonatis, }
Glycerini, 4.00 c.c. (ʒ i)
Aquæ, 30.00 c.c. (ʒ i)

℞	Tinct. iodi comp.,	4.00 c.c. (ʒ i)
	Phenol (crypt),	1.16 c.c. (gr. xviii)
	Glycerini,	75.00 c.c. (ʒ iiss)
	Aq. dest.,	30.00 c.c. (ʒ i)
		(Bolton)

℞	Ichthyol,	2.00 c.c. (ʒ ss)
	Aquæ,	120.00 c.c. (ʒ iv)

The following antiseptic solutions are often recommended in suppurative inflammation, malignant growths and fracture of the nose:

℞	Resorcin,	.18 c.c. (gr. iii)
	Glycerini,	4.00 c.c. (ʒ i)
	Aquæ,	

℞	Phenol,	.30 gm. (gr. v)
	Glycerini,	4.00 c.c. (ʒ i)
	Aquæ,	30.00 c.c. (ʒ i)

℞	Potass. permang.,	.06 gm. (gr. i)
	Aquæ,	30.00 c.c. (ʒ i)

℞	Formalin (40%)	.30 c.c. (gtt. v.)
	Aquæ,	30.00 c.c. (ʒ i)

(4)	℞	Sodii bicarb.,	30.00 gm. (ʒ viii)
		Sodii bibor.,	30.00 gm. (ʒ viii)
		Sodii benzoatis, Sodii salicylatis, āā	1.20 gm. (gr. xx)
		Eucalyptol, Thymol, āā	.60 gm. (gr. x)
		Menthol,	.30 gm. (gr. v)
		Ol. gaultheriæ,	.36 c.c. (gtt. vi)
		Glycerini,	45.00 c.c. (ʒ viijss)
		Alcoholis,	60.00 c.c. (ʒ ij)
		Aquæ, q. s. ad.	8.00 liters (Oxvj)
	M.	For Seiler's solution.	
	Signa.	To be used in an atomizer.	

(5)	℞	Ammoni chloridi,	2.4 to 4.8 gm. (gr. xl–lxxx)
		Aquæ, Aquæ mentholis, āā	240.00 c.c. (ʒ viii)
	Signa.	To be used in atomizer.	

(Recommended by Shurley as a cleansing and mildly stimulating solution.)

(6) ℞ Sodii benz., 15.00 gm. (ʒ ss)
Aquæ calcis, 240.00 c.c. (ʒ viii)
(Recommended by Shurley for cleansing in acute coryza.)

(7) ℞ Sodii chloridi, .30 gm. (gr. v)
Sodii bicarb., .36 gm. (gr. vi)
Borolyptol, 15.00 c.c. (ʒ ss)
Aq. destill., q. s. ad. 30.00 c.c. (ʒ i)
Signa. To be used in atomizer.

Astringent solutions are vegetable and mineral and are indicated in exudative inflammation of the nose and throat. Among the formulæ frequently recommended for use in atomizer at home and in the physician's office are:

℞ Glycerol tannic, 4.00 c.c. (ʒ i)
Aquæ, ad. 30.90 c.c. (ʒ i)

℞ Argenti nitratis, .18 gm. (gr. iii)
Aquæ, 30.00 c.c. (ʒ i)

℞ Argenti nitratis, .04 gm. (gr. ½)
Aquæ, 30.00 c.c. (ʒ i)

℞ Alumeniis, .60 gm. (gr. x)
Aq. hamamelis dest., 8.00 (ʒ ii)
Aquæ, q. s. ad. 30.00 c.c. (ʒ i)

℞ Zinc sulph., .24 gm. (gr. iv)
Aquæ, 30.00 c.c. (ʒ i)

℞ Zinc phenolsulphonate, .12 gm. (gr. ii)
Aquæ, 30.00 c.c. (ʒ i)

℞ Formalin (40%), 1.20 c.c. (qt. xx)
Aquæ, 30.00 c.c. (ʒ i)
M. For tubercular laryngitis.

In addition to the aqueous solutions, many solutions composed of refined albolene as a base, with one or more chemicals in solution are indicated after cleansing and direct medication to the nose and throat. It is necessary that some preparation of this character be sprayed into the nasal cavity to cover and protect the denuded

mucous membrane. Otherwise, infection or hyperemia results, which may lead to an attack of acute coryza. This is especially true when the patient goes immediately out of doors after treatment.

Oil solutions may be used in the ordinary spray or in a nebulizer (Fig. 72).

In the treatment of the upper and lower air passages, nebulizers manufactured by the Globe Nebulizing Company and De Vilbiss are in great favor.

There is a distinct advantage in using the nebulizer over the atomizer in that stronger solutions can be used.

Fig. 72.—De Vilbiss Nebulizer.

It is to be remembered that an oil spray, if used for a great length of time, may fill the glands of the mucous membrane, bringing about a functional and structural alteration. The following solutions are frequently used in atomizer and nebulizer:

℞	Camphor,	.24 gm. (gr. iv)
	Menthol,	.24 gm. (gr. iv)
	Albolene,	30.00 c.c. (℥ i)

℞	Thymol,	.12 gm. (gr. ij)
	Menthol,	.12 gm. (gr. ij)
	Albolene,	30.00 c.c. (℥ j)
		(Brown)
℞	Thymol,	.60 gm. (gr. x)
	Menthol,	1.20 gm. (gr. xx)
	Eucalyptol,	1.20 c.c. (gtt. xx)
	Ol. cubebæ,	.60 gm. (gtt. x)
	Benzoinol,	180.00 c.c. (f℥vj.–M)
		(Douglas)
℞	Chloretone,	.42 gm. (gr. viiss)
	Camphoræ,	4.50 gm. (gr. lxxv)
	Menthol,	4.50 gm. (gr. lxxv)
	Ol. cinnamoni,	.42 c.c. (gtt. viiss)
	Ol. petrolinæ,	90.00 c.c. (℥ iii)
		(McClintock)
℞	Acetoform,	.60 c.c. (gr. x)
	Camphor, Menthol, āā	1.20 c.c. (gr. xx)
	Eucalyptol,	.30 c.c. (gtt. v.)
	Petronol (Lilly), q. s.	120.00 c.c. (℥ iv)
		(Masters)
℞	Acetozone,	0.50 gm. (gr. viii)
	Chloretone cryst.,	0.50 gm. (gr. viii)
	Ol. petrolatum,	90.00 gm. (℥ iii)
℞	Olive oil,	8.00 c.c. (℥ ii)
	Aristol,	1.20 gm. (gr. xx)
Signa.	Dissolve, and add to the following:	
	Acetoform,	.60 gm. (gr. x)
	Camphor,	1.20 gm. (gr. xx)
	Menthol,	1.20 gm. (gr. xx)
	Eucalyptol,	.72 c.c. (min. xii)
	Albolene,	60.00 c.c. (℥ ii)
M.		

The above solutions are applicable as a routine measure in the treatment of acute and chronic catarrhal and acute and chronic purulent affections of the nose and throat, also asthma, ulcer of the trachea, tracheitis, and acute and chronic bronchitis following direct medication.

The following solutions are indicated in the treatment of the enumerated affections of the upper and lower air passages:

℞	Menthol,	.60 gm. (gr. x)
	Albolene,	60.00 c.c. (℥ ij)
		(Brown)

In chronic pharyngitis:

℞	Menthol,	.35 gm. (gr. vi)
	Ol. caryoph.,	.67 c.c. (gr. xi)
	Albolene,	30.00 c.c. (℥ j)
		(Brown)
℞	Thymol,	.06 gm. (gr. j)
	Menthol,	.35 gm. (gr. vi)
	Ol. anisi,	8.00 c.c. (℥ ij)
	Albolene,	30.00 c.c. (℥ j)
		(Brown)
℞	Ol. menth. pip.,	4.65 c.c. (℥ j¼)
	Albolene,	30.00 c.c. (℥ j)

In naso-pharyngeal catarrh:

℞	Thymol,	.65 gm. (gr. xi)
	Menthol,	1.30 gm. (gr. xx)
	Eucalyptol,	1.30 c.c. (gtt. xx)
	Ol. cubebæ,	2.50 c.c. (gtt. xl)
	Benzoinol,	178.00 c.c. (℥ vj)

For general use after alkaline spray:

℞	Creasoti,	4.00 c.c. (℥ j)
	Ol. picis. liquidæ,	1.25 c.c. (gtt. xx)
	Albolene,	15.00 c.c. (℥ ss)

In laryngeal tuberculosis:

℞	Camphoræ,	.06 gm. (gr. j)
	Menthol,	.24 gm. (gr. iv)
	Ol. santali,	.30 c.c. (gtt. v)
	Albolene,	30.00 c.c. (℥ j)

In rheumatic pharyngitis:

℞ Ol. gaultheriæ, .12 c.c. (gtt. ij)
Camphor-menthol, } āā .12 c.c. (gtt. ij)
Ol. eucalypt., }
Cocain. hydrochloratis, .13 gm. (gr. ij)
Benzoinol, 30.00 c.c. (℥ j)

Use with a spray for acute laryngitis, pharyngitis, coryza, etc

℞ Resorcin, } āā .06 gm. (gr. j)
Tinct. iodi, }
Camphor-menthol, .12 gm. (m. ij)
Ol. eucalypti, .18 c.c. (gtt. iij)
Benzoinol, 30.00 c.c. (℥ j)

Signa. Use in spray for chronic catarrh, adenoids, hypertrophy, etc.

Among formulæ in common use with the Globe nebulizers, are the following:

℞ Ol. eucalypti, .92 c.c. (gtt. xv)
Menthol, .32 gm. (gr. v)
Benzoinol, .30.00 c.c. (℥ j)

Signa. Use with a nebulizer for simple catarrh of the nose, throat and bronchial tubes and after the first stage of all acute inflammations.

℞ Ol. caryophylli, .46 gm. (gr. vij)
Creasoti (beechwood), .97 gm. (gr. xv)
Ol. picis. liq., .97 gm. (gr. xv)
Iodi, .46 gm. (gr. vij)
Benzoinol, 30.00 c.c. (℥ j)

Signa. Use with a nebulizer for pulmonary and laryngeal tuberculosis and in any condition requiring an active antiseptic.

℞ Creasoti (beechwood), 1.00 c.c. (m. xv)
Ol. picis. liq., 1.00 c.c. (m. xv)
Benzoinol, 30.00 c.c. (℥ j)

℞ Eucalyptol, }
Ol. cassiæ, } āā 4.00 c.c. (℥ j)
Creasoti, }
Ol. picis. liq.,
Albolene, q. s. ft. 120.00 c.c. (f℥ iv)

Signa. Use with nebulizer in pulmonary and laryngeal tuberculosis. Healing and antiseptic.

℞	Iodi,	.32 gm. (gr. v)
	Ol. picis. liq.,	.92 c.c. (m xv)
	Camphor-menthol,	2.00 c.c. (gr. xxx)
	Ol. gaultheriæ,	1.00 c.c. (m xv)
	Albolene,	30.00 c.c. (℥ j)

Signa. Use with neubulizer for chronic naso-pharyngeal and bronchial catarrh. Alterative and antiseptic.

℞	Acetezone crystals,	.50 gm. (gr. viii)
	Chloretone crystals,	.50 gm. (gr. viii)
	Refined bland mineral oil,	90.00 c.c. (℥ iii)

Signa. For chronic bronchitis; antiseptic.

Inhalations.—This form of treatment for the mucous membranes of the upper air passages has, for a long time, received the universal recognition of the medical profession. Numerous instruments of simple and complicated construction, all on the same principle,

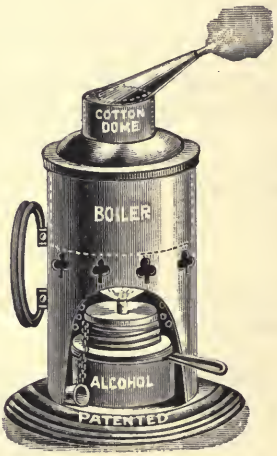

FIG. 73.—SIMPLEX INHALER.

are on the market. They consist of a spirit lamp, water reservoir and bulb-tube, midway of which is placed a sponge in which the fluid to be inhaled, is placed. The steam from the boiling water, in passing through the sponge, is impregnated with the medicine

and by deep inhalations, is carried into the larynx and bronchi. A much cheaper instrument, known as a hot-water inhaler, consists of an ordinary cup with a long tube for inhaling the steam and may be had for the sum of twenty-five cents. Where the perfected instrument cannot be had, the benzoin inhaler will prove a very good substitute.

The principle involved is that certain drugs in boiling water or steam, thus impregnated, can be carried deep into the large bronchi. Inhalations are of special value in treating laryngeal affections. Those remedies recommended, especially, possess the virtue of being antiseptic, astringent and sedative, among which are:

℞ Tinct. benzoini comp.,	15.00 c.c. (℥ ss)
Aquæ, q. s.	480.00 c.c. (℥ xvj)
℞ Phenol,	.92 c.c. (gtt. xv)
Aquæ, q. s.	480.00 c.c. (℥ xvj)
℞ Tinct. iodi,	.42 c.c. (gtt. xv)
Aquæ, q. s.	480.00 c.c. (℥ xvj)
℞ Creasoti,	.92 c.c. (gtt. xv)
Aquæ,	480.00 c.c. (℥ xvj)
℞ Tinct. opii,	3.75 c.c. (℥ j)
Aquæ,	30.00 c.c. (℥ j)
℞ Ferri perchloridi,	.12 c.c. (gtt. ij)
Aquæ,	30.00 c.c. (℥ j)
℞ Zinci sulphatis,	.12 gm. (gr. ij)
Aquæ,	30.00 c.c. (℥ j)

The following formulæ are from the London Throat Hospital:

℞ Creasoti,	2.10 c.c. (gtt. xxxij)
Magnesii carbonat.,	3.75 gm. (℥ j)
Aquæ destill.,	30.00 c.c. (℥ j)
℞ Ol. cubebæ,	.06 c.c. (gtt. j)
Magnesii carbonat.,	1.30 gm. (gr. xx)
Aquæ destill.,	30.00 c.c. (℥ j)

℞ Ol. pini sylvestris, 2.50 c.c. (gtt. xl)
Magnesii carbonat., 3.75 gm. (ʒ j)
Aquæ destill., 30.00 c.c. (ℨ j)

℞ Spt. camphoræ, 3.75 c.c. (ʒ j)
Spt. vini rect., 1.95 c.c. (gtt. xxx)
Aquæ destill., 30.00 c.c (ℨ j)

Sedatives:

℞ Ferri sulph., .97 gm. (gr. xv)
Aquæ, 30.00 c.c. (ℨ j)

℞ Ferri et ammon. sulph., .97 gm. (gr. xv)
Aquæ, 30.00 c.c. (ℨ j)

℞ Iodi, 1.92 gm. (gr. xxx)
Potassii iodidi, .32 gm. (gr. v)
Aquæ, 30.00 c.c. (ℨ j)

℞ Acidi hydrocyanici, 3.75 gm. (ʒ j)
Aquæ, 30.00 c.c. (ℨ j)

Signa. Teaspoonful of the above formulæ to a pint of water.

Gargle.—Unless used scientifically, solutions prescribed for this method of treatment are of little value, especially in the treatment of the posterior pillar of the tonsils, pharynx and larynx.

Investigations by Pope, of San Francisco, with methylene blue, mucilage and magnesia, when used as a gargle, show that the pharynx remains untarnished, while the tongue, hard palate and anterior pillars were covered with the pigment.

Should it be found necessary to recommend gargles, patients should be instructed to fill the mouth with the fluid, close the nose tightly, throw the head far back and gargle. By this method, fluids will reach the pharynx and posterior walls of the tonsils. The following are some of the formulæ frequently used:

℞ Borolyptol, 30.00 c.c. (ℨ i)
Phenol, .96 gm. (gr. xvj)
Glycerini, 8.00 c.c. (ʒ ij)
Aquæ mentholis, q. s. ad. 120.00 c.c. (ℨ iv)
M.
Signa. Antiseptic gargle.

℞ Acidi tannici, } āā 2.40 gm. (gr. xl)
Alumni, }
Aq. rosæ, 120.00 c.c. (℥ iv)
M.
Signa. As a gargle in hemorrhage following tonsillotomy.

℞ Tr. ferri chlor., 4.00 c.c. (℥ i)
Potas. chloritis, 2.00 gm. (gr. xxx)
Glycerini, 4.00 c.c. (℥ i)
Aq. dest., 30.00 c.c. (℥ i)
M.
Signa. Follicular tonsils.

℞ Zinci phenolsulphonatis, .30 gm. (gr. v)
Glycerini, 4.00 c.c. (℥ i)
Aquæmentholis, 30.00 c.c. (℥ i)
M.
Signa. For acute pharyngitis.

Douche.—This form of application of medicated water, especially to the nose, has in recent years been almost relegated to the past. For cleansing and treating the nasal cavity, it was first introduced by Weber, of Halle, Germany. The author of this method recommends that the reservoir should not be elevated above the eyebrows. This is done in order to lessen the liability of the entrance of fluid, during the act of swallowing, into the Eustachian tube where it might pass into the middle ear, causing severe inflammation. The danger of using the douche must not be under-estimated, since disturbances in the sense of smell, headache and suppuration of the middle ear may be occasioned.

Since Weber introduced this method, a great many douches have been devised. The Kirkpatrick and Birmingham douches are more highly recommended. Those instruments should be held gently in the nose, allowing the fluid to flow naturallly and without the assistance of the patient in snuffing through the nose. The long-continued use of the douche is to be condemned as it may act as an irritant and thus aggravate rather than palliate disease.

Lichwitz recommends that the douche should only be used when there is something to remove, such as increased secretions and crusts.

Following this mode of treatment, the nasal cavity should be carefully cleansed with cotton and probe, after which some bland application should be made. The solutions usually prescribed for a douche are the same as used in an atomizer.

Paraffin Prothesis.—Paraffin prothesis for the correction of deformity of the nose and auricle, has become a routine practice, judging from the abundance of literature on the subject, since its introduction by Gersung, in 1900.

Paraffin prosthesis is recommended for the correction of saddle nose, atrophic rhinitis (Helsmortic), deformities resulting from opera-

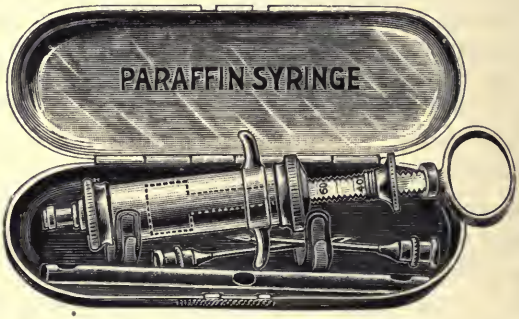

FIG. 74.—SMITH'S PARAFFIN SYRINGE.

tions upon the frontal sinuses (Broeckaert), and deformities of the external ear following the radical mastoid operation (Alt).

Whether or not the paraffin, which becomes encapsulated, will break up and become disintegrated, is a matter for future investigators. At the present time it is believed that it will remain encysted the same as a bullet or small shot. On account of the lightness of paraffin, gravity will play but little part in displacing the hardened paraffin.

According to Eckstein, the paraffin should have a high melting point beyond that possible for the tissue to reach under any pathological condition, thus avoiding the possibility of an embolism ever being detached. The melting point of the paraffin recommeneded by Dr. Smith is 110° F.

Technique.—The cutaneous tissue should be scrubbed with soap and water, followed by pure alcohol. If within the nose, cleansing with a mild antiseptic spray is necessary. The needle and syringe should be sterilized in boiling water. The sterilized paraffin should be brought to the melting point and drawn into the warmed syringe, where it is allowed to cool sufficiently to make a fine white thread as it is expelled from the syringe. In this condition, the needle is inserted to about the farthest extremity of the tissue to be pushed out and by slowly twisting the screw plunger of the syringe, sufficient amount of paraffin is injected into the parts. During the process of injection, the injected paraffin should be moulded into the desired shape. The amount of paraffin injected will depend upon the size of the deformity. Over-correction should be avoided. Local anesthesia is not always necessary in the correction of saddle nose and auricular deformities. A great many patients make but little complaint without anesthesia. The Schleich's mixture may be used in those cases demanding local anesthesia. If within the nasal cavity, a four per cent. solution of cocain may be applied direct to the mucosa, followed by adrenalin.

Massage.—A great variety of massage otoscopes are recommended. Since this form of therapy is constantly demanded in the treatment of many diseases of the ear, the choice of a durable instrument is essential.

Those with the motive power furnished with electricity and air do not, in the end, prove as satisfactory as those manipulated by hand, such as the Siegle, Bishop, Ballenger or Delstanche. In the latter, the advantage and danger of having the drum obscured is remedied by having it attached to the Siegle otoscope.

This form of therapy of the ear is especially indicated when the membrana typmani is very much retracted and drawn inward as a result of stenosis of the Eustachian tube, inflammatory changes within the middle ear and slight fixation of the stirrup in the oval window. By a process of rarefaction with the Siegle pneumatic speculum (Fig. 63), the air, by gentle pressure upon the small rubber bag, is gradually driven out of the auditory meatus and in so doing, the membrana tympani is, if adhesions are not too great, drawn outward.

In the use of different massage instruments, it is necessary that we avoid undue vibration or stretching of the drum; otherwise, congestion may result. To prevent the inward collapse of the drum, after it has been drawn into its normal position, a large plug of cotton, dipped into collodion, should be inserted immediately within the meatus.

Politzer recommends dipping the wool in oil and placing in the meatus for a gradual rarefaction of air within the external meatus.

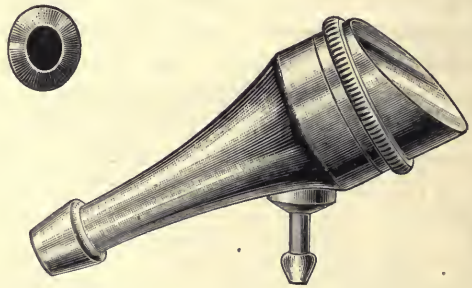

FIG. 75.—BURNETT'S MODIFIED SIEGLE'S OTOSCOPE.

Hommel recommends for gentle massage of the drum, pressure with the finger upon the tragus. By alternately pressing inward, there is condensation and rarefaction of the air in the auditory canal. The different methods mentioned not only favor retraction of the drum but act as a mild stimulus to the mucous membrane of the middle ear, causing an increased flow of blood and lymph through the parts and absorption of catarrhal exudation.

Gentle massage is very effectual, if applied with conservatism, when we have connective tissue deposits within the middle ear with partial or complete ankylosis of the ossicles or anesthesia of the tensor tympani muscle. Massage, especially in young children, should be used with great care, on account of the liability of producing atrophy of the drum. This form of treatment should be administered two or three times weekly, for a period of from six to eight weeks. Conspicuous redness along the malleal plexus or membrani flaccida should counter-indicate the treatment.

Lucae's (Fig. 76) pressure probe is now and then indicated when the ossicles are completely ankylosed. This instrument is so applied as to press inward the short process of the malleus. Gentle pressure is made with this instrument four or five times at one application. Manipulation of the pressure probe sometimes produces some reaction and severe pain. This form of massage is indicated, according to Lucae, when we have a negative Rinne, with a loss of hearing for speech.

As a therapeutical measure in the treatment of the upper air passages, massage has not met with as favorable use in this country as

FIG. 76.—LUCAE'S PRESSURE PROBE.

in Europe. Dr. Baun (Trieste), in 1891, first advocated vibratory massage of the upper air passages and demonstrated his method before the International Medical Congress at Berlin. In the words of the author:

"I employ two principal forms of movement in massage of the mucous membrane of the nose, naso-pharynx, pharynx, larynx and the upper part of the trachea: They are stroking and vibration, and the two are combined in such a way that each part of the mucous membrane is thoroughly stroked and massaged. Copper probes of three sizes with olive points to correspond to the parts to be treated, as the Eustachian tube, naso-pharynx, pharynx, larynx and trachea, are used. To manipulate the probe, it is held as a pen: four hundred vibrations are thus given per minute; hand manipulation being too slow, an electric vibrator giving two thousand vibrations per minute may be used. The point of the probe is carefully wrapped with cotton saturated with the remedy indicated and carefully applied to the whole mucous membrane."

Dr. Dionisi (Turin), (*Journal of Rhinology and Otology*, Vol. VIII., 1894,) described a bag made of India rubber to be introduced into the nasal cavity and blown up with air, which causes it to come in

contact with a vibrator by the tube. The vibrator consists of a chamber of air, vibrations being transmitted by means of a piston.

As in other parts of the body, massage produces a greater physiological activity of the parts. Braun remarks, "That the diminished sensibilities produced by massage give to the mucous membrances a greater resistance against agents which act upon it harmfully." He recommends the following:

℞	Menthol, Vaselin,	10 per cent.
℞	Balsam peru, Vaselin,	10 per cent.
℞	Sol. hydrarg., Alcoholis,	1–1,000
	Lanolini, Iodi-glycerini, } āā	10 per cent.

Massage is contraindicated in acute inflammatory conditions and indicated in all chronic inflammation of the nose, throat and Eustachian tube, as hay-fever, nasal asthma, trigeminal neuralgia, atrophic nasal catarrh, ozena, chronic pharyngitis, chronic tonsillitis, chronic laryngitis and laryngeal paralysis. Unless applied systematically, little good may result. It should be administered daily until requirements are met. Stroking is the form of massage indicated in the cervical region. The patient sits with the head thrown slightly backward; the operator stands facing the patient as in the Gerst method. If the patient stands the operator stands behind. The strokes are downward and outward with a moderate degree of pressure. In children, the patient is laid upon the lap of the operator and nurse, operator facing the child. With head thrown slightly back, the neck is grasped with the fingers on the vertebræ and the thumbs to the larynx, and the downward strokes are made with the thumbs.

Thermic Agents.—Heat and cold are two terms well known to the profession and to the laity, yet their rational application is not always based upon sound philosophy or experience.

"The application of extreme degrees of heat and cold is practically identical and consists in the destruction of tissue, so that freezing and

burning may produce somewhat similar appearances of the tissue and cause like symptoms. Slightly lower degrees of heat still act much like extreme cold, tending to coagulate albumin, to stimulate involuntary muscles, to contract blood vessels and thus check bleeding, to lower the action and vitality of tissues and microörganisms and to retard metabolism" (Friedenberg). The reaction is in direct ratio to the intensity of the heat and cold.

Cold applications may be subdivided into dry and moist cold and when applied, cause contraction of the blood vessels, lowering of temperature, preventing or altering the exudation of inflammatory products, thus acting as a slight antiseptic and anodyne. Care should be taken that the cold applications are not continued for too great a length of time, for fear of causing necrosis or increased irritation.

Dry cold is best applied to the ear or throat by means of cracked ice in bladders, rubber bags or ice water passed through the Leiter tube, which is more often used than any other method. This is especially indicated in mastoid inflammation, in that the tube can be moulded to fit the parts. In acute inflammation of the mastoid, it should not be used to exceed forty-eight hours. In the absence of the Leiter tube, resort may be had to ice bags. To excite contraction of the carotid artery, Urbantschitsch recommends Winternitz's India-rubber neck-bag, through which ice water is kept flowing.

Moist cold is applied by irrigation or by dipping soft towels into iced solutions and then applying them directly to the nose, throat or ear. The application of moist cold being disagreeable to both the patient and nurse, the dry cold is recommended.

In chronic inflammation of the throat, a sudden application of cold water to the throat externally acts as a stimulant. In patients predisposed to catarrhal troubles during cold and damp weather, sponging the chest and neck with cold water in a great many cases, has a beneficial effect in preventing such trouble, if used with regularity upon arising. This is recommended in children as well as adults. The cold tub or plunge bath is especially recommended upon arising for individuals with a catarrhal predisposition. This form of bath will frequently bring about a marked resistance of the mucosa of the nose and throat to recurrent attacks of acute coryza. In a few isolated

cases, the shock of a cold plunge is too great; such cases should be content with the cold sponging of the neck and chest.

In acute inflammation of the throat, in the very beginning of the trouble, ice packs externally and Dobell's solution (iced) or cracked ice in the mouth, is indicated. Ordinarily, the ice bags should not be applied more than a half hour at a time. However, they may be repeated at short intervals.

The application of heat may be subdivided into two forms, dry and moist.

Dry heat is more pleasant to the patient than moist heat, as it is more constant, easy of application and soothing in effect. In the application of moist and dry heat, the surgeon must be governed by the condition of the case. Dry heat may be applied by hot water bags, hot sand or salt bags, hot water bottle, Japanese hot-box, constant temperature of water through tubes and hot flannels. Heat, when applied dry, has the faculty of increasing the circulation and thus facilitating and encouraging the absorption of inflammatory products, as in acute inflammation of the middle ear, lessening of the tension, and acts as an anesthetic to irritated and painful nerve terminals.

Moist heat is best applied to the ear or throat and covered with rubber or thick cloth to prevent evaporation. Heat in this form stimulates the localization of pus by softening the tissue. One disadvantage experienced in its application is the inconsistency of temperature.

Poultices are now, as of old, a universal method of applying moist heat to the surface. Certain unguenta, such as antiphlogistin, etc., are recommended in the form of poultices to the throat and mastoid. They should be thoroughly heated before applying. The heat may be best maintained by the addition of a hot water bottle to the poultice. The hydroscopic effect of the glycerin is evidently the potent factor of such poultices. Others are ground flax-seed, ground barley from breweries, bread crumbs moistened with milk, and fat meat, so often used in country districts. It is essential that poultices be covered with oiled silk or greased paper that the even temperature may be more easily retained.

Electricity.—Electricity is closely allied to massage. The best results of massage are frequently dependent upon electricity as an auxiliary (Dawse).

Electricity as a massage is to be considered as adjunct to other therapeutical measures, such as medicine, rest, etc.

It is especially indicated in the ear in chronic catarrhal inflammation in anemia of the labyrinth, and inflammatory exudations within the labyrinth and middle ear. It is indicated in torpidity of the endothelial lining of the middle ear, tympanum and Eustachian tube, want of auditory nerve activity or partial paralysis, stenosis of the Eustachian tube, hyperesthesia of the labyrinth and neurasthenia.

In sclerosis of the middle ear, Dundas Grant recommends mechanical vibration to the spine between the shoulders, a direct current causes indirect massage of the stapedio-vestibular joint.

There is great disparity of opinion relative to the efficiency of electricity, brought about in many cases by want of knowledge of the pathology of the case or the obscurity of the disease, to terminate its indication. Furthermore, to secure results, an accurate instrument must be used, combined with knowledge of electricity as applied to medicine.

As applied to therapeutics, the following forms are used: faradic, galvanic, electro-cautery, static, X-ray, high frequency current and advisedly, illuminating and electro-trephining.

The ampere is the unit of the rate of galvanic current flow. The number of ma. obtained as a dose in proportion to the effect desired expresses the rate of current flowing through the tissue. Increase indicates the intensity of action on the nerves and muscles. Rate of movement is an equally important factor in practical work with all the different currents. In static currents, the rate of motion is the all-important factor.

The faradic, as all understand, is characterized by being alternating and interrupted, while in the galvanic, the current is constant and continuous. The faradic has low amperage and high voltage, while the galvanic has greater amperage and low voltage.

"Faradism is indicated where we wish to excite the motor or sensory nerves and to increase the volume of the muscles. This is accom-

panied by exciting contraction, which increases the temperature and at the same time increases the nutrition. To relax a tense muscle or to loosen a peripheral contractor, single shocks from a strong current are generally more useful than a galvanic" ("Electro-therapeutics," Haynas).

The faradic current is especially indicated up to about three ma. in facial paralysis, following operations upon the mastoid or ossicles, sclerosis of the middle ear, hyperesthesia of the auditory nerve, hyperemia of the labyrinth and tinnitus where it is not dependent upon change of the circulatory system.

The faradic current for tonic effect should be generated from a fine, high tension coil, about eight thousand feet in length.

Up to a certain point, the faradic current is a builder of tissue. When it reaches the point of irritation, it acts as a destruction to tissue.

Galvanic.—The galvanic current is more especially indicated where we wish to produce stimulation of the whole muscular and nervous system. A mild galvanic current is soothing to irritated nerve filaments.

Static electricity, generated, as a rule, from specially constructed machines, is administered in the form of a bath, breeze or induction coil, and is recommended in those disorders associated with disturbances of the trophic system.

The **X-Ray** is generated from a static machine or induction coil and is indicated in the treatment of cancer, chronic ulcers, eczema, lupus, for the location of foreign bodies in the larynx, trachea and those imbedded about the auricle.

Cautery.—The point of the cautery should be heated for all purposes to a cherry red and applied to the affected parts. It is especially recommended in hypertrophy of the turbinates, applied directly to the mucous surface or driven deeply into the tickened turbinates. In withdrawing the point it is necessary that it remain heated; otherwise, it will adhere to the tissue. Following the application of the cautery point, suppuration immediately takes place to the depth equal to the amount of destruction. If the operator exercises due care, as a rule, results are very satisfactory, and on the other hand, if we cause too great destruction of the tissue, the function of the mucous

membrane may be entirely destroyed, and an atrophic degeneration results. It is especially recommended in phlyctenular pharyngitis chronica, with varicosities of the small blood vessels, in hypertrophy of the tonsils, in hemorrhage following the operation for the removal of the tonsils and in neoplasms of the respiratory tract.

"On account of the edema produced, the cautery should not be used about the uvula, the faucial pillars, arytenoid region or on the glosso-epiglottic fold. It should not be used on the middle turbinates or the tissue above. Its application to the posterior end of the inferior turbinate is best avoided; likewise, cauterization of the septum."

Electro-trephine may be used for the removal of spurs from the septum, opening into the antrum of Highmore, mastoid and frontal cells.

Application of Electrodes.—In a given case demanding stimulation by the galvanic current, the negative pole is applied to the affected part and the positive to the nape of the neck. Where a sedative influence is demanded, the positive pole is applied to the affected part and the negative to the nape of the neck. Bishop's ear electrode will be found very convenient for use in aural affections.

Time of Treatment.—The seance should not last over five minutes and the current should not be over three ma. in strength.

Cautery Snare.—Used for the removal of enlarged tonsils or hypertrophies within the nose, care should be taken that the wire is kept at sufficient heat to sever the tissue without producing hemorrhage.

Especially constructed handles are adapted to the use of the physician. The current can be turned on or off instantly by means of a trigger.

The **electrolytic bougie** designed by Duel for the obliteration of strictures within the Eustachian tube and the promotion of absorption of exudates from the middle ear, are made of solid gold and are of three sizes. An insulated cord connects the gold bougie with a negative pole of the galvanic battery. An insulated Eustachian catheter especially constructed, is necessary. The catheter should be bent at a slightly greater angle than for ordinary catheterization. The tube is passed into position and firmly held while the small,

gold bougie is passed through the Eustachian catheter into the Eustachian tube. As soon as a stricture is met there is an obstruction, which, if very thin, will be readily passed. The positive pole, or sponge-electrode, is placed at the nape of the neck or held in the patient's hand. The. current necessary to promote absorption of a stricture is from three to five ma., which should be turned on as soon as the electrode is in position and should not be continued for longer than three to five minutes. The electrode should be extracted while the current is still on. The current should not be turned on stronger, on account of the destruction of tissue which follows the burning. There is no pain accompanying or immediately following the treatment. This form of treatment may be continued once weekly until all strictures are easily passed. The Eustachian tube should not be inflated immediately after the electrolytic bougie has been passed. However, the patient should return the following day and submit to a gentle inflation of the Eustachian tube.

Radium.—This substance is obtained from pitchblende, found in Joachimsthal, Bohemia, and was introduced to the medical profession as a bromide or chloride of barium, by Prof. and Mme. Curie, of France. Radium has the property of giving off heat and light and may be had in small tubes, which are placed in small rubber holders and inserted against the tissue under treatment for from five minutes to half an hour daily. Beck reports radium as a distinct analgesic in a case of sarcomata of the nose, in a woman sixteen years of age. The effect of the radium was noted after the fourth day's treatment. Radium is highly recommended in the treatment of malignant tumors.

Finsen Light.—To Finsen is due the credit of separating the chemical rays and the calorific rays from the sun and the application of the chemical rays to the cases of lupus, epithelioma, lupus vulgaris, tuberculosis of the nose and larynx, and acne. The action of the chemical rays is to destroy the parasitic or chemic agents producing the disease and a restoration of the lowered local metabolism. In the method of Finsen, the caloric and luminous rays are separated from the solar rays by passing the latter through a solution of copper sulphate and diluted ammonia water. The strength of the solutions is so

regulated that the heat rays are reduced to a point of tolerance and the chemical rays are stimulated to their highest intensity.

The duration of the treatment is from one to two hours. The patient experiences no uncomfortable reaction from the treatment other than a slight itching sensation. To add to the efficiency of the treatment, Finsen recommends that the parts be rendered as anemic as possible, and this is accomplished by compression or an application of ice.

A Finsen instrument may be secured through any of the large instrument supply houses.

Lamps for the concentration of the chemic rays from the arc lamp are recommended as a substitute for the Finsen light. The arc light, to possess any virtue, should be one consuming from seven to fifteen amperage.

CHAPTER IX.

SUPERHEATED AIR, SOLUTIONS, VAPORS AND BOUGIES IN THE TREATMENT OF THE EUSTACHIAN TUBE, MIDDLE EAR AND ACCESSORY SINUSES.

Superheated Air.—The following, relative to the application of hot air in the treatment of diseases of the ear, nose and throat, is copied from the summary proceedings of the International Medical Congress, August 5, 1900, and reported to the *Laryngoscope*, January, 1901, being a report of the research of M. Lermoyez and G. Mahu, of Paris.

"We propose to apply to circumscribed areas of the mucous membrane currents of dry air, superheated to a temperature of 80° to 100°, a method which recalls those employed by Hollander and Jayle in dermatology and gynecology. The supply of air under pressure is furnished by steel tubes containing the air under pressure of 120 atmospheres; the latter is heated in a metallic worm and is conducted to its destination by supple metallic tubes with a double coating of asbestos. At the end of this tube are screwed canulæ of various size and shape, according as it is desired to apply hot air to the turbinates, at the Eustachian openings or in the ear. At the base of the canulæ there is attached a regulator of the temperature and pressure.

Applications of hot air are made under the control of the vision, with a head-mirror and speculum; sitting lasts two minutes, and is repeated two or three times a week. As a rule from eight to ten sittings are necessary to obtain a good result. This treatment is perfectly painless. The entrance of the hot air brings about an intense retraction of the mucous membrane which is soon followed by abundant, watery, offensive secretions, which cease in a few moments. The value and effect produced by this treatment shows

itself next; at first temporary, it tends to become permanent. Applications of hot air have especially succeeded with us in cases of chronic congested coryza, with intermittent nasal obstructions. It gives results remarkable as well as lasting, provided there is not yet angiomatous degeneration of the nasal mucous membrane. It rapidly suppresses the sneezing and other nervous symptoms of spasmodic coryza. It dries the flow of nasal hydrorrhea, and brings back the nasal mucosa to its normal objective state. In hay-fever, in which our experience is still more recent, it seems to relieve the attack. Finally, it gives good results in aural troubles, deafness and tinnitus, associated with catarrh of the nose and naso-pharynx; otalgia gives way to it almost immediately.

An attempt to make this treatment the panacea of all diseases of the nose would be to condemn it to rapid loss of consideration. We believe it useful to state that it has, up to the present, given no results in ozena, purulent catarrh, nasal and naso-pharyngeal diseases which justify surgical treatment."

For making an application of heated air to the Eustachian tube the heater devised by Seeley is inexpensive and thoroughly practical. A hard-rubber catheter and Pynchon's inflator complete the outfit.

The hard-rubber catheter, being a poor conductor of heat, can be used longer than one of solid metal. In the Pynchon inflator is placed a small piece of sponge saturated with equal parts of menthol, camphor and tincture of iodin. The hot air impregnated with the fumes is forced into the Eustachian tube and middle ear.

Solutions may be carried to the Eustachian tube and middle ear by being forced through the Eustachian catheter by a moistened bougie passed through a metallic catheter or injected through a long flexible Eustachian catheter attached to an ordinary hypodermic syringe, after the plan designed by Clevenger, or a short rubber tympanic catheter.

For the introduction of fluid into the tube without its entering the tympanic cavity, Politzer (p. 272) recommends the following:

"An air douche having first been administered, eight to ten drops of the solution are injected into the catheter with a Pravez syringe; the head of the patient is now bent to the side and a little backward,

by which means the fluid flows from the catheter into the tube. In this manner concentrated solutions of zinc sulphate (2:10), and Burlow's solution, as well as weak solutions of tannic acid (½ per cent.) or a few drops (5–10) of sterilized liquid vaseline (Delstanche) may be applied to reduce the swelling in the tube. The author has found the latter, combined with zincolein (0.3: 30–0), beneficial in marked swelling of the tube. In obstinate cases, astringents are sometimes successful only when preceded by injections of an ammonium chlorid (1:10–20) or soda bicarbonate (3:10–20) solution. Steam and ammonium chlorid vapor, as recommended by V. Trolstch and Burkner, rarely reduce the swelling of the tubal mucous membrane. Turpentine vapor (oleum terebin) aspirated from the vial by means of an air-bag and forced through the catheter into the middle ear, has proved more useful. Bronner (*Arch. of Otology*, 1891, vol. xx.) recommends the vapors of the oils of eucalyptus and menthol. The author has often found the latter drug very serviceable in marked swelling of the mucous membrane of the tube. Hartmann introduces a few drops of iodin-glycerin (iodin pur. 0.3, kali hydroiod. 3–0, glycerin. pur. 10.0–20.0) by means of the catheter in obstinate forms of swelling of the tube. Alt speaks highly of the effect of hot air inflations in marked swelling of the tube (p. 106) and claims that they have a very beneficial influence in alleviating troublesome head symptoms."

Sterilized oils and solutions may be injected into the Eustachian catheter in situ and with compressed air forced directly into the Eustachian tube and middle ear. Indications for injections into the Eustachian tube and the middle ear must be well marked and solutions sufficiently diluted to avoid any violent reaction.

The following are some of the solutions frequently used and their indication:

℞	Protargol,	20–50 per cent. solution
℞	Solution nitrate of silver,	½–1 per cent.

Five to ten drops of one of the above solutions should be injected into the catheter in situ and with compressed air or a Politzer bag,

forced into the Eustachian tube and is indicated in acute and chronic catarrhal inflammation. In pronounced syphilitic affection of the middle ear, Politzer recommends the following:

℞ Potassii iodidi, .30 gm. (gr. v)
Aquæ, 30.00 c.c. (℥ i)
M.

Signa. Ten to twenty drops for one injection, combined with antisyphilitic treatment.

℞ ½ per cent. camphor-menthol in albolene.
M.

Signa. Ten to fifteen drops to be injected while warm into the Eustachian tube and middle ear.

Indicated in acute and chronic catarrhal inflammation of the Eustachian tube:

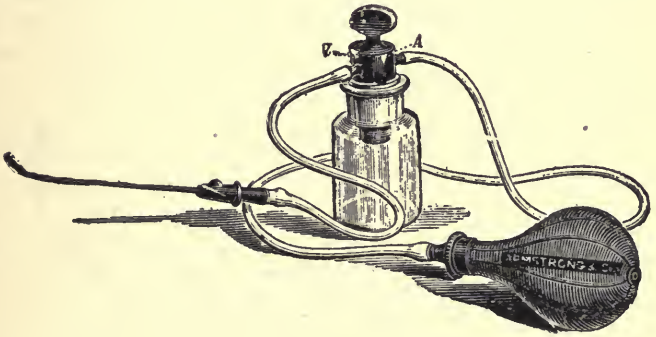

FIG. 77.—DENCH'S MIDDLE EAR VAPORIZER.

℞ Sodii bicarbonatis, .60 gm. (gr. x)
Pilocarpine muriatii, .12 gm. (gr. ii)
Albolini, 30.00 c.c. (℥ i)
M.

Signa. Ten drops to be injected in adhesions of the Eustachian tube and adhesive catarrh of the middle ear.

Vapors.—For the injection of vapors, the Dench middle ear vaporizer (Fig. 77) is of great efficiency. Medicated vapors are especially indicated as a mild stimulant in chronic hypertrophy and

adhesive middle ear catarrh. The following are recommended by Dench:

℞ Menthol, Camphoræ, āā		3.90 gm. (ʒ j)
Alcoholis,		30.00 c.c. (ʒ j)
℞ Menthol, Camphoræ. āā		3.90 gm. (ʒ j)
Tinct. iodi,		30.00 c.c. (ʒ j)
℞ Ol. eucalyptol, Ol. pini, āā		15.00 c.c. (ʒ iv)
℞ Ol. caryophylli,		1.90 c.c. (m. xxv)
Alcoholis,		30.00 c.c. (ʒ j)

Bougie.—This form of treatment for the dilation of the Eustachian tube was first introduced by Bonnafont and Kramer. The bougie may be used as a diagnostic measure in discovering the permeability of the tube, as a mild massage to the mucous membrane, reduction of stricture and for medication of the mucous membrane. For dilatation the bougie should remain in position from six to ten minutes, followed by inflation. As a mild stimulant, it may be gently passed in and out a few times for one minute. For medication, the bougie may be dipped in a solution, and while moist, passed into the tube through the canula. The length of the Eustachian tube should always be kept in mind in passing the bougie so that we may then avoid injury to, or rupture of, the drum. The amount of force necessary to reach the middle ear varies according to the size of the obstruction. In the normal case, an Eustachian bougie should pass without any effort. In strictures of some size, slight force may be necessary and as soon as the stricture is passed the bougie will slip along very easily.

Too much force is to be condemned, as a false passage may be made or so much destruction to the mucosa brought about that stenosis is encouraged.

Bougies are made of hard rubber and are filiformed in character. A number of sizes are to be had, all small enough, however, to be passed into the normal middle ear. The comparative value of

bougies of this kind, and the electrolytic bougies of Duel, is still a disputed question. Some aurists prefer the ordinary bougie, believing it possesses all the virture of the electrolytic. Personally, I believe the electrolytic bougie has many advantages in the relief and cure of stricture of the tube. From the nature of things, the negative current applied as in this method should add just as much more influence in promoting absorption of exudates.

CATHETERIZATION OF ACCESSORY SINUSES AND INTER-TYMPANIC IRRIGATION.

Frontal Sinuses.—With the nasal mucosa round about the naso-frontal duct anesthetized with a four per cent. solution of cocain, under good illumination, in from approximately forty to fifty per cent. of cases, the catheter can be placed within the frontal sinus (Fig. 78).

Hypertrophy of the middle turbinate sometimes makes it necessary to remove the anterior end before the catheter can be placed.

FIG. 78.—HARTMANN'S FRONTAL SINUS CATHETER.

The presence of the catheter within the sinus may be shown by transillumination or by measuring from the meatus of the nose to above the supra-orbital ridge along the outside of the nose.

The Hartmann canula (Fig. 78) is more frequently used. Under good illumination, it is directed into the middle meatus. The handle of the canula is lowered and the point is directed upward

and forward. In favorable cases, the point enters the frontal cells. In a great number of cases, the operator will have great difficulty in catheterizing the frontal sinuses. Jurasy only introduced the catheter eleven times in twenty-one cases; Lathrop in an examination of two hundred and fifty skulls, found that he could pass a probe into the sinus in but twenty-five per cent. (Lack).

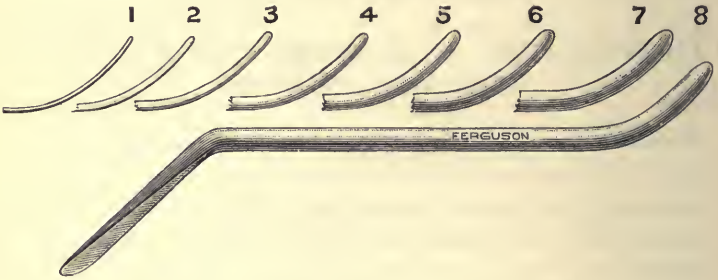

Fig. 79.—Freeman's Frontal Duct Bougies.

The sinuses may be washed once daily with a mild and warm antiseptic solution, in chronic catarrhal or purulent inflammation.

Frontal duct bougies for probing and dilating the naso-frontal duct and for keeping the opening free after operation, are especially designed and recommended by Walter J. Freeman.

The Maxillary Antrum.—The position of the ostium varies in individuals. Normally, it empties into the middle meatus. On

Fig. 80.—Killian Trocars.

account of the variations in size of the ostium and hypertrophy of the middle turbinated body, the size of the turbinated body and large bulla, it is frequently very difficult to successfully irrigate through the natural opening. Under good illumination and cocain anesthesia, the Hartmann or Killian canula or the Freeman irriga-

tion tube is passed into the middle meatus slightly beyond the middle third. Killian's trocar is also recommended for puncturing through the middle meatus. The opening may be perfectly round or slit-

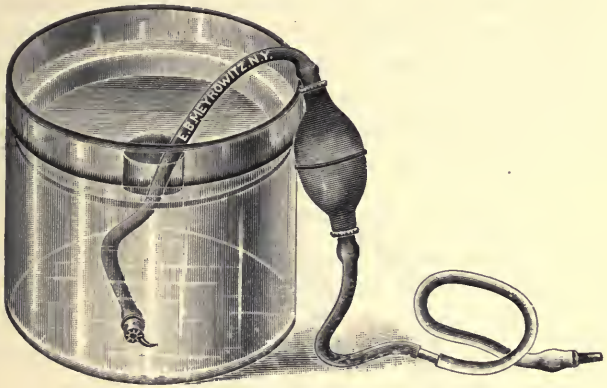

FIG. 81.—BOWL FOR STERILE WATER, WITH SYRINGE.

like in the bony wall, where the point of the tube is bent at an angle. It is turned outward and downward into the ostium. Catheterization is indicated for the diagnosis of exudation within the antrum

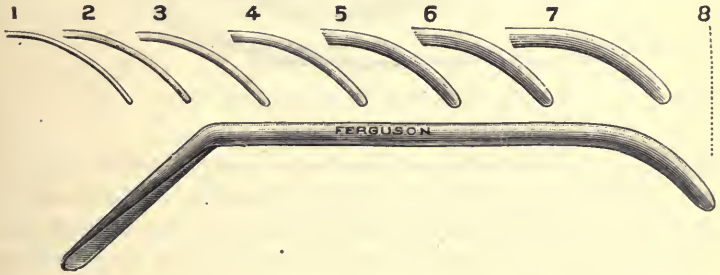

FIG. 82.—FREEMAN'S SPHENOID BOUGIES.

and treatment of acute and chronic inflammation of the maxillary antrum.

Ethmoidal Sinus.—On account of the anatomical structure of the ethmoidal cells, it is impossible to irrigate unless the middle turbinated

body is removed. For the cleansing of the attic, the De Vilbiss single barrel spray is very efficient.

Sphenoidal Sinus (Fig. 35).—The sphenoidal sinus can be reached in about forty per cent. of cases, through the natural opening. The distance from the anterior nares to the ostium is from two and one-half to three and one-half inches (St. Clair Thomson). With this in mind, the Grünwald sphenoidal canula should be passed up between the middle turbinate and the septum of the nose at an angle of forty-five degrees, until it strikes the roof of the nose. It is now

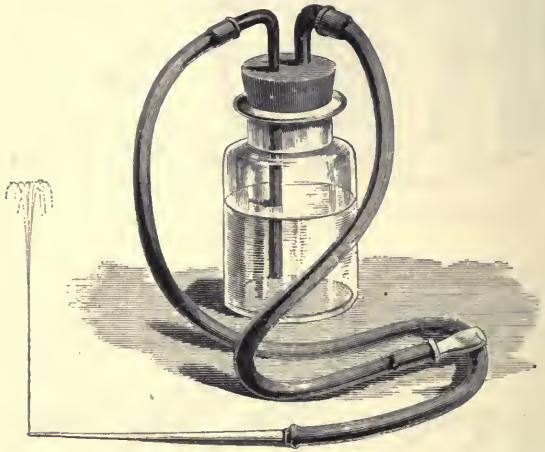

Fig. 83.—Hovell's Tympanic Irrigator.

gently guided downward and backward when it passes into the sinus. If the canula is in the ostium, according to Grünwald, it can not be moved downward. In the greater number of cases, free access to the sinus is only gained by the removal of the middle turbinated bone.

With the canula in the ostium, mucus and pus may be blown out by attaching a Politzer bag or irrigating with a syringe. If the ostium is small, there is usually a great deal of pain following irrigation. Remotely, the ostium will be found very large and easy of access.

Intertympanic Irrigation.—For the cleansing of the Eustachian tube and tympanic cavity where there is a perforation of the membrana tympani, irrigations with mild antiseptic and astringent solutions are frequently indicated.

The catheter should be placed in position at its greatest curve, as shown by auscultation and with a 100 c.c. syringe, fluids can be forced through the Eustachian tube and out of the external meatus. There is no pain accompanying this form of therapy and the patients experience a great deal of relief from irrigation in chronic purulent diseases of the middle ear.

For irrigating through the external meatus or middle ear, a syringe or Hovell's tympanic irrigator is necessary (Fig. 83).

With large ear speculum and good illumination, the perforation in the drum can be passed through with the point of the irrigator. Cleansing solutions and astringents can be applied to all the parts of the tympanic cavity. Warm Dobell's or Seiler's solution may be used for irrigation.

CHAPTER X.

GENERAL THERAPEUTICS.

Local Anesthetics.—In the daily use of cocain it should be applied and so masked that the patient is none the wiser for its use. It will be observed that a great many patients display a wonderful amount of knowledge relative to this drug and in a number of cases object to its use. For operative use in the nasal cavity a four per cent. solution, freshly prepared, is more often selected. Very few operations in the nose require a stronger solution. In dissection of the tonsils ten to twenty per cent. is recommended, while in paracentesis of the tympanum, a few drops of a ten per cent. solution should remain in the ear for at least ten minutes preceding puncture. For diagnostic purposes in the nose, a two per cent. solution is sufficient. The anesthetic effect is accompanied by drying of the mucous membrane and contraction of the blood vessels. Its continued use is harmful to the mucous membrane. Cocain solutions should be frequently sterilized, as they rapidly deteriorate, being most effective when applied fresh and warm to the mucous surface. It may be applied either by cotton wrapped on a probe or by spray.

"The best antidote for the toxic effect of this drug is amyl nitrate and ordinary wine, placing the patient in a recumbent position." The application of the anesthetic value of subarachnoid injection of cocain in the nose, throat and ear surgery, is still undeveloped. Payne, of San Francisco, reports two simple mastoid operations and one Stacke operation under spinal analgesia.

The injection is made between the third and fourth lumbar vertebræ. The patient is placed in a reclining position with the back slightly bowed. The skin at the site of the injection is thoroughly cleansed and the surface is anesthetized by spraying by ethyl chlorid. With a glass syringe and a specially constructed needle, twenty

drops of a sterilized solution of cocain are injected into the subarachnoid space.

Stovain is a new anesthetic of French origin, which may be called chloralhydrate of amylin, and is highly recommended in oto-rhino-laryngology by Dubar, chief of the Oto-rhino-laryngological Clinic, in the Maison-Blanche, and by Reclus, Chaput, and Tuffier, as a spinal analgesic.

Dr. Tapia, Madrid, in a report of an experimental investigation of the drug as compared with cocain, says stovain is less toxic, is the equal of cocain, is a good antiseptic and on account of a mild diuretic property, is quickly eliminated from the system.

Stovain may be used in the same strength of cocain. In the ablation of adenoids, Dubar especially recommends stovain because it does not contract the tissue as observed under cocain anesthesia.

Eucain introduced as a substitute for cocain in the nose and throat, may be used in five to ten per cent. solutions. Two preparations are dispensed: eucain alpha and eucain beta. The latter is said to be three and seventy-five one-hundredths times less toxic than the former.

As previously remarked, solutions of cocain deteriorate while those of eucain retain their virtue indefinitely, though they demand occasional sterilization. The contraction of tissue is not so distinct, consequently, as a diagnostic remedy applied to the turbinate, eucain is of little value, but when used hypodermically, it is equal to cocain.

For anesthesia of the nasal cavity, a four to five per cent. solution is indicated. For tonsillotomy, a twenty per cent. solution may be applied directly to the tonsil. In the removal of adenoids, a fifteen to twenty per cent. solution is indicated.

Orthoform is a white, odorless, tasteless powder; a local anesthetic, which is slow in action but lasting in effect, covering a period of thirty-six to forty-eight hours. Since it is only slightly toxic, it may be applied ad libitum, being especially recommended in the relief of pain in wounds, burns, excoriations, also after cauterization in the nose and throat, in dysphagia and cough due to tuberculosis and in ulcerated conditions of the pharynx, larynx, carcinoma and abscess of the larynx, after operation on the mastoid, eczema of the

ear and about the nose in hay-fever. According to Würdemann, orthoform may sometimes produce a severe dermatitis.

Freudenthal recommends the following emulsion:

℞	Menthol,	10.00 gm. (ʒ ijss)
	Ol. amygdalæ dulcis,	15.00 c.c. (ʒ ss)
	Vitelli ovi,	15.00 c.c. (ʒ ss)
	Orthoform,	12.50 gm. (ʒ iij)
	Aquæ destill., q. s.	100.00 c.c. (ʒ iij)

As a powder.

℞	Orthoform,	4.00 gm. (ʒ j)
	Menthol,	2.00 gm. (gr. xxx)
	Zinci stearatis,	4.00 gm. (ʒ j)

Many drugs, though not so classed, possess more or less anesthetic properties. For instance, in operating for paracentesis of the drum, the application of pure carbolic acid along the line of intended incision, renders the operation as nearly painless as if obtained under cocain and the caustic effect in no wise interferes with the healing of the drum. In dissection of the tonsils or cauterization of the throat, the application of a ten per cent. solution of carbolic acid has a marked anesthetic effect.

Bonain recommends the following, which is an anesthetic:

℞	Phenol, Menthol, Cocainæ hydrochloratis,	āā	1.0 gm. (āā gtt. xv)

and

℞	Phenol,		1.0 gm. (gtt. xv)
	Menthol, Cocainæ hydrochloratis,	āā	0.5 (āā gr. viij)

which is an anesthetic and caustic.

These solutions, as remarked by the author, meet various affections of the ear. In the nose they may be used in exploratory puncture of the maxillary sinus, in galvano-cauterization of the turbinates, for ulcer or epistaxis, for reduction of inflamed tissue and

last for anesthesia of the anterior orifices of the nasal fossæ, a region upon which cocain has no action. They should be applied every eight to ten minutes. They are valuable in the cauterization of hypertrophied adenoid tissue in the oro-pharynx and at the base of the tongue, where cocain is often inefficient. In the larynx, the anesthesia has been used for galvano-cauterization of the epiglottis and arytenoid eminences when infiltrated. It is efficacious when combating the dysphagia of tubercular ulcers of the pharynx and larynx, producing complete anesthesia, lasting at times for days. Bonain further recommends the caustic solutions for destroying tubercular vegetations. Guaiacol, in oil, is recommended as a local anesthetic to the turbinated bones and in the removal of polypi of the nose and ear. For operations upon the tympanic membrane, Bonain recommends the following formula:

℞	Guaiacol,	.6 gm. (gr. x)
	Menthol,	.3 gm. (gr. v)
	Cocainæ hydrochloratis,	.3 gm. (gr. v)

After cleansing the auditory canal, the above is applied by means of à pledget of cotton. A complete anesthetic effect is obtained in three minutes.

Antipyrin in aqueous solutions or in oil has a peculiar anesthetic effect upon the mucosa of the turbinated bones. In acute coryza it is recommended in spray of one per cent. solution.

℞	Antipyrini,	1.90 gm. (gr. xxv)
	Tr. opii,	.60 gm. (gtt. x)
	Aquæ destill.,	90.00 c.c. (℥ iij)

As an anesthetic, it may be used preceding cocain or eucain, to the mucous membrane thirty minutes before operating.

Narcosis.—Narcosis, as applied to surgery, is a condition of general unconsciousness, produced by irrespirable gases, more especially chloroform, ether, nitrous oxid gas, or ethyl bromid.

Two conditions are essential to a safe narcosis, *i. e.*, the sound physical condition of the patient and an experienced anesthetizer. Considering the fact that anesthetics are given by hundreds of

physicians throughout the country, who are little versed in the skillful use of the same, we must confess such physicians possess an element of luck, that so few deaths occur by this means. Only in the hands of those skilled in the administration of anesthetics should be placed the chance of the life of the patient and the reputation of the operator. Too many young physicians go out into the world with a poor conception of the danger of using anesthetics. The specialist, starting on a promising career, should be guarded in the choice of those who are to administer anesthetics to his patients. The physical condition of the patient must not, except in emergency cases, be overlooked. The mere fact that his heart beats are rhythmic and urine normal should not outweigh the general physical condition of the patient.

"Those with so-called lymphatic temperament, neurasthenics, anemics, chlorotics and leukemics, stand anesthetics and operations poorly" (Hamilton Fish).

As between ether and chloroform, the majority of the operators regard chloroform as the safer anesthetic for children because there is less hemorrhage accompanying operations than from ether. As the scale of life advances, ether promises the less risk to life. In laryngectomy and other operations upon the larynx and trachea, chloroform promises the best results; likewise in mastoid operation and in the extraction of foreign bodies from the external auditory canal, Asch operation, etc.

Chloroform is regarded by Weyth as especially dangerous to children under twelve years of age, on account of lymphatic diathesis, which at this age is most prevalent. Kalisko reports that in children dying from chloroform narcosis, a condition described as "habitus lymphaticus" exists.

Ethyl bromid is a modern chemical discovery obtained by a distillation of a mixture of ethyl alcohol, sulphuric acid and potassium bromid. In its pure state it is a colorless liquid, having an odor similar to chloroform. It is dispensed in one-ounce tubes, one of which is sufficient to cause narcosis lasting one-quarter of a minute. It is of especial service when operating upon children for adenoids and removal of tonsils. The child is held in the nurse's arms in an

upright position, wrapped in a sheet to guard against struggling. The small glass point of the bottle is broken off and the contents poured on a napkin and held over the mouth and nose of the child. Narcosis is soon produced. Where a more lasting narcosis is necessary, the combination of chloroform and oxygen is recommended.

The position of the child and adult depends upon the length of the narcosis desired. If prolonged, as in the Asch operation, the patient is placed upon a table with the head dropping over the edge. In many operations upon the nose and throat, removal of malignant and non-malignant growths, resection of the maxilla, etc., the Trendelenburg position is essential. In this way, the probability of blood passing into the larynx is avoided, for, as remarked by Dr. Keen, "Blood will not flow up hill any more than water."

In major operations, as the Asch operation, resection of the maxilla, cleft palate, tracheotomy, laryngotomy, etc., chloroform is more often indicated.

In the removal of tonsils and adenoids, a general narcosis is exceedingly dangerous; the pain of the operation in children is so small as compared with the greater danger of the anesthetic, that only in the exceptional cases should other than a local anesthetic be used.

If there is profound obstruction of the nasal space from adenoids, the A.C.E. mixture offers the minimum amount of danger. The child should lie flat on its back, with head and neck slightly elevated. In operating, the child's head should be gently dropped over the end of the table. The mouth gag should be previously inserted in giving the nitro-oxid gas or ethyl bromid. In the administration of ether or chloroform the gag may be inserted after partial anesthesia.

Post-operative Treatment.—Following an operation under local or general anesthesia, the patient should be put in a comfortable position, compatible with free drainage. After the removal of tonsils or growths within the nasal cavity under local anesthesia, the patient, if in the office of the physician, should remain perfectly quiet for from one to two hours.

Turbinectomy or curettement of the sinus should be done in a hospital. To prevent hemorrhage, iced spray of adrenalin 1–5,000 in 1–4 Dobell's solution should be sprayed into the nose every hour.

The patient should remain in bed from fifteen to twenty-four hours, with the head and shoulders slightly elevated.

Iced liquid diet only should be given patients for the first day, followed on the second day by soft foods, with a complete restoration of diet in forty-eight hours.

After the removal of spurs from the septum it is better to prescribe cold liquids for the first meal following the operation.

Following paracentesis, the patient may become faint and nauseated, requiring stimulation with brandy or whiskey.

After general anesthetic as in the Asch operation, operation upon the mastoid, etc., more or less shock and collapse may result, which demands hot-water bottles to the feet, elevation of the foot of the bed, attention to the respiration or the administration hypodermically or per os of brandy and strychnin sulphate.

In the opinion of the author, it is a bad policy to administer a general anesthetic in the physician's office. It is dangerous to perform tonsillectomy and tonsillotomy where there is a probability of subsequent hemorrhage, in the private office of the physician. The grosser operations should be done at the private apartments of the patient or in some well-equipped hospital, so that there can be no demand for exertion on the part of the patient after the operation. Severe hemorrhage may follow turbinectomy or tonsillotomy and occurs more often in patients who are allowed to spend an hour or two in the effort to reach home. In operations of any proportion, where local anesthetics have been used, it is wise to put the patient to bed immediately.

After an operation upon the nose or throat, the patient should lie flat upon his back, with head and shoulders slightly elevated. For the first twelve hours, cracked ice dissolved in the mouth will aid in checking hemorrhage. If it is from the nose or tonsils and becomes profuse, cracked ice to the nape of the neck and hot-water bottles to the feet are recommended. Preceding and during operation, especially when cocain or eucain is used as an anesthetic, many patients become faint and nauseated. To the uninitiated, these symptoms tend to rob the operator of a certain confidence essential to good work. This nausea is very often due to a psychical condition

rather than to the narcotic effect of the local anesthetic. The patient soon revives under stimulants and words of encouragement from the operator. After many operations, fainting is not a bad condition, sometimes being nature's relief for what otherwise might be a fatal hemorrhage.

Vomiting may follow local or general anesthesia. The patient suddenly becomes prostrated, pale and nauseated, with profuse excretions of saliva. The ejected matter is often the stomach contents, food substance, saliva, gastric juice and bile. Relief of depressing symptoms quickly follows emptying of the stomach. Where the vomiting becomes obstinate, we must resort to some therapeutic remedy for its relief, such as:

℞ Acetanilidi,	.97 gm. (gr. xv)
Sodii bicarb.,	1.30 gm. (gr. xv)
Caffeinæ citratis,	.32 gm. (gr. v)

Fiat chart No. V.

Signa. One powder with a little cracked ice or brandy and repeat in one hour if necessary (*Journal American Medical Association*).

"Very hot water or the other extreme, iced champagne or Apollinaris sometimes brings relief." Mustard to the epigastrium is also recommended.

Rectal enema of hot water, six to eight ounces, to which is added a little brandy, will relieve the marked thirst which sometimes accompanies severe vomiting. Morphin hypodermatically and oxalate of cerium is efficacious.

Hiccough may be relieved by the use of morphin or iced champagne. Some recommend forcible extension of the tongue. The bladder should not be forgotten. If resort to the catheter is necessary, it should be sterilized previous to use. Hot applications to the bladder will often relax constricted muscles.

After opening the mastoid, turbinectomy, operation upon the septum, removal of the tonsils, tracheotomy, etc., all solid foods are contraindicated. Fluids, soft and lastly solid diet, all in their natural course, are indicated as the severity and character of the operation demands. If, after the second day, there is not free evacuation of the bowels, resort to enema or gentle laxative is imperative.

Hemorrhage may often follow operations upon the nose and throat. To prevent hemorrhage from the nose, it is best to spray the nose with a solution of adrenalin chlorid (1–10,000). This should be repeated every half hour until all tendency to hemorrhage has passed away. It is sometimes necessary to pack the nose with strips of iodoform or bichlorid gauze, previously saturated with a solution of campho-menthol in albolene. Camphor and menthol are both slightly stimulating and the albolene will prevent the saturation of the gauze with blood and serum and lessen the liability of the gauze fibers adhering to the wound.

When small spurs have been removed from the septum, a thin strip of gauze saturated with the campho-menthol solution may be carefully placed over the wound, and this, in turn, covered with thin strips of gauze. A safe rule to follow is that of never allowing the dressing to remain in the nose over forty-eight hours. When the septum is especially dressed, as described above, the small gauze strips covering the wound may remain for fifty-two hours, the nose being irrigated frequently with warm Dobell's solution. By this a secondary hemorrhage may be prevented. The annoying feature of many operations upon the nose is hemorrhage following the removal of the first dressing. To prevent this, adrenalin 1–5,000 may be applied, as far as possible, to the mucous surface about the wound. The nasal mucosa should be partially anesthetized with a solution of cocain before the dressing is removed.

Rise of temperature after operation upon the ear, nose and throat is rare. If the operation has been accompanied by shock, we may look for reactionary rise of temperature. If the temperature continues elevated, an investigation for the cause is necessary.

Local Depletion.—By this term we universally imply the extraction of vitiated blood from inflamed tissue. This is best accomplished by the natural or Heurteloup's leech.

The natural leech is a spindle-shaped worm, dark olive-green in color. They are best known by the name of American, German and Spanish leeches. In all acute inflammations of the mastoid and middle ear they are in universal favor. In applying them to the surface it is best to prick the skin so that the leech may more readily

attach itself. For convenience, the leech is placed in a two-drachm bottle with its head directed toward the opening of the bottle and in this position it readily takes hold after which the bottle is quickly removed. Before using, it is best to pass the leech through pure, clear water, freeing it as much as possible from all extraneous matter. Leeches gradually suck themselves full, finally relax and drop off. From one to two drachms of blood are usually extracted by a single leech. Leeches should not be used a second time. Formerly, leeches were applied to the inside of the nose and conjunctiva; they are now usually applied to the temple, side of the nose, tragus, and, as mentioned, to the mastoid. If the amount of blood extracted is insufficient, the continuation of bleeding can be encouraged by the application of hot water. As a rule, the hemorrhage from the wound is rather profuse and continues often for hours. Mechanical and chemical measures may be resorted to for its stoppage.

Artificial Leech.—The artificial leech of Heurteloup is best explained by the illustration. It is in many respects very unsatisfactory and should not be used when the natural leech is at the disposal of the surgeon.

FIG. 84.—HEURTELOUP ARTIFICIAL LEECH.

Other local measures in inflammation are applications of tincture of iodin to the throat and mastoid, tincture of turpentine and the dry cup. Cantharidal collodion is also used now and then as a blistering liquid to the mastoid and temple.

Diaphoretics.—"Indications to stimulate superficial circulation, the elimination of morbid products through the skin, the promotion of metabolic changes and reabsorption of exudates."

Those now in universal favor are pilocarpin muriate, given in one-tenth grain hypodermatically and others such as jaborandi and salicylates. The latter are often disagreeable and should be dis-

guised by giving in menthol waters. In addition, we have the dry pack (where patients are wrapped in woolen blankets and given jaborandi), hot-air baths, electric baths and steam rooms which are useful, therefore, in syphilitic affections, rheumatism, sclerosis of the middle ear, tinnitus and chronic conditions of the middle ear.

Inunction.—Inunctions of mercury are more especially applicable in the treatment of syphilis. For convenience, the mercury is carefully mixed with pure lanolin and dispensed in capsules, one capsule containing four grains of mercury, that amount being sufficient for one treatment. The nurse should protect her hands with rubber gloves, otherwise, before the cycle of inunction is complete, she will, in all probability, suffer from the absorbed mercury. The inunction should be administered to the inner surface of the arms and legs and to the abdomen and chest. This should be continued daily, until the symptoms of mercurialism are produced. Daily hot baths will be very efficacious in bringing about immediate results. While the cycle of inunction is in progress, due care should be given the teeth, keeping them perfectly clean. It is best to wash the teeth frequently with a weak solution of potassium chlorate.

Constitutional Treatment.—The constitutional treatment consists in the administration of those remedies which are indicated to combat anemia, syphilis and general debility, among which preparations are hypophosphites of lime, soda and arsenic, potassium iodid, iron, quinin, cod-liver oil.

Hydrotherapy.—*Foot Baths.*—In many acute inflammations of the nose, throat and ear, warm foot baths are of great use in affecting the circulation to these parts by relieving congestion. Mustard meal may be added to the water to stimulate the skin circulation. The bath should last for one-half hour. The patient is then put to bed, wrapped in blankets with hot-water bottles to the feet to guard against reaction.

Turkish Baths.—With this form of bath we have free sweating and massage of the muscles. This form of therapy is especially indicated in many affections of the ear, nose and throat, especially when there is a chronic exudation within the sinuses of the nose, chronic pharyngitis, laryngitis, exudation within the labyrinth, etc.

Cold Baths.—Cold baths are valuable as a general tonic to the skin and mucous membrane of the nose and throat. They should be taken upon arising and thus aid in preventing colds. Baths are of value as a general tonic in hysterical neurasthenia or general debility. Patients should take a cold tub bath or cold sponge bath and if the shock of the cold tub bath is too much the patient may apply cold water with a sponge or towel to the neck and chest.

Warm General Baths.—Warm full baths should be given at a temperature of 100–110° F. Sea salt may be added to the water. This bath given daily will have a beneficial effect upon children suffering from a scrofulous diathesis, chronic purulent rhinitis, eczematous condition and general debility.

Astringents.—Probably among the mineral astringents, nitrate of silver is more often indicated.

Protargol, in varied solutions, is in general favor. It is a silver albumose containing eight per cent. of metallic salt. It was first discovered by Chemist Eichengrum and introduced as a therapeutic agent by Benario. It differs from the nitrate of silver in that the nitrate is dependent upon its power to precipitate albumin from the epithelial layer with which it comes in contact. In this way the epithelium is detached and with the contained bacteria is destroyed (Hirschberg). While protargol does not precipitate albumin, it penetrates deeper into the cellular tissue, thus acting as a deep astringent, antiseptic and bactericide without irritating properties.

Argyrol, in a strength varying from five to fifty per cent., is equally as efficacious as protargol and less irritating and is especially indicated in the treatment of ulceration and acute and chronic purulent inflammation of the ear, nose and throat.

In acute and chronic catarrhal conditions of the nose and throat, the following solutions are universally used:

Argentum nitratis,	½ per cent.
Argentum nitratis,	1 per cent.
Argentum nitratis,	2 per cent.
Argentum nitratis,	5 per cent.
Argentum nitratis,	8 per cent.
Argentum nitratis,	25 per cent.

Protargol,	2 per cent.
Protargol,	5 per cent.
Protargol,	8 per cent.
Protargol,	20 per cent.
Protargol,	50 per cent.
Argyrol,	5 per cent.
Argyrol,	25 per cent.
Argyrol,	50 per cent.

In purulent inflammation of the middle ear with perforation, on account of the germicidal action, solutions of five per cent. protargol or twenty-five to fifty per cent. argyrol are well borne and are of great value.

Argyrol, in fifty per cent. solution, is especially efficacious as a local application to the mouth of the Eustachian tube in chronic catarrhal inflammation of the tube and middle ear. In acute rhinitis, a two per cent. solution of ether sprayed into the nose, often produces a beneficial effect.

Argonin, like protargol or argyrol, is a compound of silver salt, a white powder, non-irritating, soluble in hot water. It is a powerful bactericide in solutions of 1–1,000 and 1–5,000. It is especially indicated in flushing the middle ear in acute and chronic otitis media purulenta. Drs. Gray and Thompson recommend it in two to five per cent. solutions to stimulate closure of perforations of the tympanic membrane.

Among other astringents to be mentioned are chlorid of zinc, sulphate of zinc, oxid of zinc, iodid of zinc, alum, alumina, bicarbonate of sodium, biborate of sodium, sulphate of sodium and sulphate of copper. Many combinations of the above are now on the market, classed as newer remedies, such as borol, boricin, etc., possessing more or less value as astringents, practically, however, adding no great advance to the therapy of the diseases under consideration.

Oleo-stearate of zinc, which is prepared by precipitating stearates of zinc in benzoinated liquid albolene, is especially efficacious in the dry treatment of affections of the ear, as in eczema, as a sedative astringent to the mucous membrane of the nose, naso-pharynx, pharynx and larynx since it clings for a long time to the surface. The

following combinations are on the market: oleo-stearate of zinc, plain; oleo-stearate of zinc, with balsam Peru; oleo-stearate of zinc, with liquor plumbi subacetatis; oleo-stearate of zinc, with boric or carbolic acid; oleo-stearate of zinc, with iodin; oleo-stearate of zinc, with orthochloral-phenol; oleo-stearate of zinc, with camphor and menthol; oleo-stearate of zinc, with acetanilid; oleo-stearate of zinc, with oil pinus pumilio and eucolyptol; oleo-stearate of zinc, with oil pinus pumilio; oleo-stearate of zinc, with antipyrin.

Preparations of Mercury.—The four forms of mercury most commonly used are calomel, bichlorid, oxycyanid and yellow oxid. The first is more especially used as a purgative, as a topical dressing in ulceration of the septum and eczema of the external ear.

Bichlorid of mercury, or corrosive mercuric chlorid, as an antiseptic and antiparasitic, since 1870, has been recognized as the fin-de-siecle of all germicides.

In those possessing caustic properties, we are limited to very weak solutions: 1–5,000 is more often used, 1–2,000 is very irritating and painful, 1–10,000 is devoid of any painful reaction and may be continued indefinitely without ill results.

Yellow oxid of mercury is used in the form of ointment in two, four, six and eight grains to the ounce of benzoate of lard or lanolin and is a mild astringent and stimulant.

Pastilles.—A very delightful way of prescribing many drugs for local use in the pharynx, larynx and in the tonsillar affections, is in pastilles. Those prepared in Pate de Jujube are palatable and soluble.

Among those frequently prescribed are ipecacuanha, menthol, cocain and red gum, benzoinated voice, chlorate of potash and borax, red gum, eucalyptus and cocain, codein, compound eucalyptus, compound rhatany and cocain, red gum and chlorate of potash, chlorate of potash, borax and cocain, eucalyptus oil, menthol and rhatany, tannin, cayenne and black currant, tannin and black currant, menthol and eucalyptus.

Lozenges.—The following lozenges are after the formula of Sir Morell Mackenzie and are known as Bosworth's London Hospital throat lozenges. These lozenges, with the exception of those containing carbolic acid, are made with black currant and red currant

fruit pastes and are prescribed for their immediate local effect. Most of the lozenges contain seventy to eighty per cent. of fruit pastes, one to two per cent. powdered tragacanth, four per cent. sugar and varying quantities of the medicaments, according to the formulæ given.

The excipients used in these lozenges allay irritation and assist the proper action of the medicine.

Trochisci Acidi Benzoici.—

Use: A most valuable stimulant and "voice lozenge."

Trochisci Potassæ Chloratis.—

Use: Stimulating and antiseptic.

Trochisci Acidi Tannici.—

Use: Strongly astringent.

Guaiac Tannin.—Tannin 1 gr.

Tannin and Chlorate Potassa.—Tannin 1 gr.; chlorate potassa 2 gr.

Capsicum.—$\frac{1}{5}$ gr.

Mur. Ammonia and Guaiac.—1 gr. each.

Trochisci Cubebæ.—(Each lozenge contains $\frac{1}{2}$ gr. cubebs.) Marked C. B.

Use: Very serviceable in diminishing excessive secretions of mucus from pharynx, larynx and trachea.

Trochisci Guaiaci.—(Each lozenge contains 2 gr. guaiacum resin.) Marked G.

Use: A specific for arresting excrescent inflammation of the tonsils and pharynx.

Aural Suppositories.—In many affections of the external auditory canal or middle ear, the following prepared suppositories are recommended:

℞	Bismuthi subnit.,	.06 gm. (gr. j)
	Ac. benzoici,	.06 gm. (gr. j)
℞	Bismuthi subnit.,	.12 gm. (gr. ij)
	Ac. benzoici,	.06 gm. (gr. j)
	Iodoformi,	.06 gm. (gr. j)
	Ac. tannici,	.12 gm. (gr. ij)
℞	Zinci sulphocarb.,	.12 gm. (gr. ij)
	Zinci sulph.,	.06 gm. (gr. j)

℞	Hydrarg. oxidi flavi,	.06 gm. (gr. j)
℞	Hydrarg. oxidi flavi,	.18 gm. (gr. iij)
℞	Hydrarg. chlor. cor.,	.06 gm. (gr. j)
	Hydro. chlor. mite,	.06 gm. (gr. j)
℞	Hydrarg. chlor. cor.,	.006 gm. (gr. $\frac{1}{10}$)
	Hydro. chlor. mite,	.12 gm. (gr. ij)
℞	Ac. salicylici,	.06 gm. (gr. j)
	Ac. borici,	.06 gm. (gr. j)
	Ac. tannici,	.06 gm. (gr. j)
℞	Ac. salicylici,	.12 gm. (gr. ij)
	Ac. borici,	.06 gm. (gr. j)
	Ac. tannici,	.12 gm. (gr. ij)
℞	Thymol,	.03 gm. (gr. ss)
	Eucalyptol,	.06 c.c. (M j)
	Chloral hydrate,	.06 gm. (gr. j)
℞	Morphinæ sulphate,	.008 gm. (gr. $\frac{1}{8}$)
	Atropinæ sulph.,	.0002 gm. (gr. $\frac{1}{200}$)
℞	Cocainæ hydroch.,	.0013 gm. (gr. $\frac{1}{50}$)
	Morphinæ sulph.,	.008 gm, (gr. $\frac{1}{8}$)
℞	Cocainæ hydroch.,	.06 gm. (gr. j)
	Morphinæ sulph.,	.0023 gm. (gr. $\frac{1}{20}$)

Smelling Salts.—Indicated for acute and chronic congestion of the upper air passages:

℞	Phenol,	1.80 gm. (gr. xxx)
	Ammonii carbonatis,	30.00 gm. (ʒ j)
	Pulveris carbonis lignin.,	30.00 gm. (ʒ j)
	Olei lavandulæ,	1.20 c.c. (M xx)
	Tr. benzoini comp.,	15.00 c.c. (ʒ ss)

Keep in well-stoppered bottles and only remove the cork when inhaling.

℞	Phenol,	3.60 gm. (ʒ j)
	Ammonii carbonatis,	8.00 gm. (ʒ ij)
	Pulveris carbonis ligni.,	8.00 gm. (ʒ ij)
	Tr. benzoini comp.,	3.60 c.c. (ʒ j)
	Ol. lavandulæ,	.36 c.c. (M vj)
	Aq. ammoniæ fort., q.s. ad.	30.00 c.c. (ʒj)

(Hall)

Somewhat stronger than the preceding.

Nasal Suppositories.—The prescribing of suppositories for the nostrils is not universal. The indication for this form of therapy is frequent and too often neglected by the rhinologists.

℞	Potassii chlorat.,	.12 gm. (gr. ij)
	Thymol,	.03 gm. (gr. ss)
℞	Potassii chlorat.,	.18 gm. (gr. iii)
	Thymol,	.03 gm. (gr. ss)
℞	Bismuth. subnit.,	.06 gm. (gr. j)
	Eucalyptol,	.06 c.c. (m. j)
℞	Iodoformi,	.06 gm. (gr. j)
	Thymol,	.03 gm. (gr. ss)
℞	Iodoformi,	.06 gm. (gr. j)
	Ac. tannici,	.12 gm. (gr. ij)
℞	Hydrarg. chlor. cor.,	.002 gm. (gr. $\frac{1}{30}$)
	Potassii chlorat.,	.06 gm. (gr. j)
℞	Hydrarg. chlor. cor.,	.002 gm. (gr. $\frac{1}{30}$)
	Potassii chlorat.,	.12 gm. (gr. ij)
℞	Ac. borici,	.06 gm. (gr. j)
	Sodii biborat.,	.12 gm. (gr. ij)
	Thymol,	.03 gm. (gr. ss)
℞	Ac. borici,	.12 gm. (gr. ij)
	Sodii biborat.,	.18 gm. (gr. iij)
	Thymol,	.06 gm. (gr. j)
℞	Ac. benzoici,	.12 gm. (gr. ij)
	Iodoformi,	.06 gm. (gr. j)
	Hydrochlor. cor.,	.002 gm. (gr. $\frac{1}{30}$)
	Cocainæ hydroch.,	.002 gm. (gr. $\frac{1}{30}$)
℞	Cocainæ hydroch.,	.06 gm. (gr. j)
℞	Cocainæ hydroch.,	.0012 gm. (gr. $\frac{1}{500}$)
	Morphinæ sulph.,	.008 gm. (gr. $\frac{1}{8}$)
℞	Cocainæ hydroch.,	.06 gm. (gr. j)
	Morphinæ sulph.,	.03 gm. (gr. ss)
	Atropinæ sulph.,	.0006 gm. (gr. $\frac{1}{1000}$)
℞	Cocainæ hydroch.,	.001 gm. (gr. $\frac{1}{50}$)
	Eucalyptol,	.06 c.c. (M j)
	Thymol,	.06 gm. (gr. j)

℞	Morphinæ sulph.,	.008 gm. (gr. ⅛)
	Zinci oxidi,	.12 gm. (gr. ij)
℞	Morphinæ sulph.,	.03 gm. (gr. ss)
	Zinci oxidi,	.06 gm. (gr. j)
	Bismuthi subnit.,	.12 gm. (gr. ij)
℞	Bismuthi subnit.,	.18 gm. (gr. iij)
	Cocainæ hydroch.,	.016 gm. (gr. ¼)
℞	Ac. tannici,	.12 gm. (gr. iij)
	Iodoformi,	.06 gm. (gr. j)
	Cocainæ hydroch.,	.01 gm. (gr. ⅙)

Aids to Hearing.—Various devices have been introduced, from time to time, as aids to hearing. It is essential that the physician knows something of the relative value of such instruments.

The conversation tubes are powerful conductors of the human voice. They consist of a hard rubber, trumpet-shaped mouthpiece, of variable size, to collect the sound waves, a small earpiece of hard rubber, a conical, elastic tube of spiral wire covered with rubber and woven silk or mohair (Fig. 85).

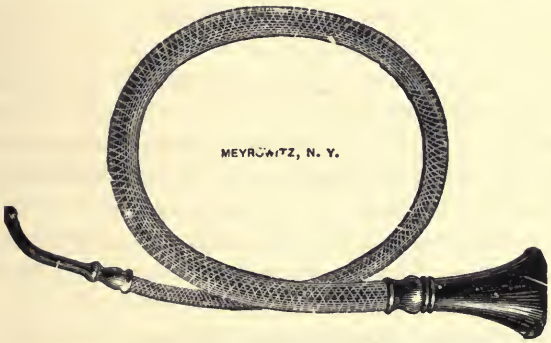

FIG. 85.—SPEAKING TUBE.

The ear-phone is one devised by Professor North. With this instrument the patient can hear voices at a distance, such as lectures, etc. This can be used either with or without the extension tube.

The London hearing dome is made in four sizes, of metal used in the manufacture of musical instruments, possessing superior acoustic properties. The dome is applied to the ear with the open end di-

rected to the sound. This instrument possesses many superior advantages and is in universal use.

Ear trumpets are of much cheaper material, bunglesome and very conspicuous.

The otophone, No. 1, is of polished black rubber, light and convenient, being carried in the pocket. This instrument is placed against the ear and is not inserted. The wave sounds do not strike direct against the drum heads but are interrupted by means of a diaphragm, as in the telephone receiver (Fig. 86). The sounds are clearer and more distinct.

The otophone, No. 2, is constructed merely for conversation. It

FIG. 86.——OTOPHONES.

consists of a mouthpiece, tube and transmitter. This is very effective in those profoundly deaf.

Politzer has designed an instrument shaped like a hunting horn to be inserted into the auditory meatus. The instrument is so constructed that the convex portion rests upon the inner side of the tragus and the opening is directed towards the cochlea. Politzer believes that the sound waves are heard more distinctly where the tragus is enlarged backward.

Artificial ear drums consist of a thin, soft-rubber disk, gold or metal stem. They are adjustable to the exposed malleus. They possess more or less efficiency. Sometimes a small pledget of cotton against the malleus will enhance wave sound.

The audiphone is a fan-shaped disk of vulcanized rubber and is of great value in many cases when bone conduction is good. The convex surface is presented to the sound and the edge of the fan is held to the teeth. It is recommended in sclerosis, etc.

CHAPTER XI.

DISEASES OF THE EXTERNAL EAR.

Injuries of the Auricle and Auditory Canal.—Injuries in this region are classed as incisions, lacerations, contusions, and gun-shot wounds.

Incised wounds, providing they are clear cut, heal, as a rule, without leaving any deformity. The treatment of incised and lacerated wounds is very much the same and consists in carefully cleansing the pinna, stitching the parts together and dressing with gauze and cotton.

Laceration more frequently follows from some foreign body striking and tearing the pinna. The laceration may extend to the meatus. In fracture of the temporal bone, the auditory canal may be torn both in its anterior and posterior wall. Under such circumstances, the hemorrhage may be very profuse and must be controlled with gauze and compresses. Stricture of the canal, which sometimes follows a tear, may be prevented by packing with gauze. In addition to the general treatment, the canal and auricle should be irrigated once daily with a solution of lysol in a strength of one-half drachm of lysol to a pint of warm water. Lacerated wounds of the pinna do not heal as readily as incised wounds, because of the injury to the tissue and the greater liability of infection.

Bites of the pinna are especially prone to become infected. There is usually more or less deformity resulting from a bite.

Contused wounds, when due to a fall, kick or blow upon the side of the head, in which the cartilage is broken, are usually followed by deformity. The effusion of blood and serum many be very small or sufficient to produce a hematoma. Deformity more often follows a hematoma. Suppuration seldom follows a bruise except in those with a debilitated system.

Symptomatology.—The symptoms of contusion are tenderness,

swelling and some pain in the auricle. Hemorrhagic discoloration more frequently occurs in the lobe of the ear.

Treatment.—The treatment in contusion consists in washing the parts with warm lysol, one-half drachm to a pint of hot water, or bichlorid solution $\frac{1}{3000}$ and dressing with gauze and cotton. Incision is demanded should an abscess form. If a slough forms, it should be irrigated twice daily with warm lysol solution and dusted with aristol. Exuberant granulations may be touched with nitrate of silver, sixty grains to the ounce of water.

If there is rupture of the drum, accompanying injury of the auricle, the auditory canal should be cleansed with a cotton-tipped probe dipped in a warm solution of lysol. If there is evidence of exudation within the labyrinth, in addition to the rest and irrigation, the patient should be given hypodermatically, pilocarpin one-tenth of a grain, once daily, and potassium iodid, ten to fifteen grains, three times daily in water.

The nose and throat should be irrigated twice daily with a warm antiseptic solution to prevent, as far as possible, infection extending to the middle ear through the Eustachian tube.

Keloid of the Auricle.—Keloid of the auricle is a hard nodule or flat growth of the skin, composed of dense fibrous tissue, developing more especially on the lobule of the ear and is due more often to injury from piercing the ears. The growth is slow and without pain, though tender to the touch. The negro race is reported to be more susceptible than the Caucasian race. The disease has a tendency to recur.

Treatment.—The X-ray is highly recommended in the treatment of keloid. Dr. A. N. Cole reports a case of keloid the size of a small marble, behind the ear, relieved after forty treatments of the X-ray, extending over a period of eight months. If the growth is very large, surgical treatment is necessary.

Exostosis and Hyperostosis.—Upon examination, the character of the growth is usually diagnosed by hardness and peculiar nodular appearance. The growth may be single or multiple and is covered with normal skin. Bony growths of this character are usually the result of a syphilitic or rheumatic diathesis.

In exostosis there is a history of a previous inflammation of the

meatus or of the canal, whereas in hyperostosis the growth is usually slow and without previous inflammation.

Exostosis makes its appearance usually near the junction of the bone with the cartilage of the canal and is pedunculated and somewhat mobile. It is somewhat variable in form. Hyperostosis appears in the bony portion of the canal. Sometimes the canal is completely occluded by the characteristic hard and mobile tumor. It may grow independent of any previous inflammation of the external auditory canal or middle ear.

Symptomatology.—The subjective symptoms are a sensation of obstruction in the auditory canal, with a constant desire to pick the ears. Partial deafness may result, not alone from the size of the obstruction, but from the impaction of cerumen and foreign substances which may gain entrance into the canal.

Treatment.—Burnett advises the extraction of exostotic growths by surgical measures. His general advice in hyperostosis is to let the growth alone, especially if the canal is not totally obstructed. When removal is indicated, it is accomplished by the electric drill. Burnett also remarked that bony growths in this position are far more frequent than is supposed.

Tumors.—Tumors (see Pathology of Tumors) of the external ear may be both malignant and benign. Epithelial tumors of the squamous variety may take their origin at the site of ulceration, polypi or necrosis of the middle ear and involve the external auditory canal and pinna.

Carcinoma may begin externally, frequently at the lobe of the pinna, and extend inward. Carcinoma, or cancer, of the accessory cavities of the nose may involve the middle ear and even the brain cavity. Carcinoma usually occurs late in life.

Numerous cases of both sarcoma and mixed tumors are reported in current literature, involving the auricle, meatus, middle ear and bony structure of the temporal bone. Sarcoma and mixed tumors may occur at any time of life.

Diagnosis.—Familiarity with certain clinical symptoms will enable the physician to differentiate the presence of a tumor. There may be some resemblance between carcinoma, syphilis and tubercular

ulcerations. Syphilis may be excluded, if in doubt, after giving heroic doses of iodid of potassium and mercury.

The histological finding is frequently the only way to differentiate sarcoma, carcinoma and mixed tumors. The specimen of the tumor with the complete history of the case and the exact location from which the specimen was removed, should, by those who do not care to carry out a careful historical examination, be sent to a pathologist for differentiation.

Treatment.—If the disease is confined to the pinna, early operative measures will frequently bring about a complete cure. On account of the great destruction of tissue, which frequently occurs before the patient consults the physician, operative treatment is only palliative. On account of the lymph supply round about the meatus and middle ear, carcinoma readily extends by a process of metastasis. Sometimes benign tumors bring about destruction of the hearing apparatus by pressure. In the removal of benign or malignant tumors, hearing may be necessarily sacrificed, as well as a certain amount of symmetry of the pinna.

Local treatment for carcinoma consists in the application of the X-ray, which should be applied twice or three times weekly for a period of from five to ten minutes.

Foreign Bodies in the External Auditory Canal.—Among the foreign bodies frequently placed in the auditory canal by children, are coffee beans, pebbles, beads, berries, small particles of wood, slate pencils, grains of wheat, flower buds, etc. Insects may crawl into the auricle of children or adults, during sleep. The position of the foreign bodies varies. If pushed beyond the isthmus, they frequently come into direct contact with the drum. Schmeigelow reports a case in which a small stone was pushed into the middle ear, through the auditory canal.

Symptomatology and Diagnosis.—In the majority of cases the presence of foreign bodies in the ear is early detected by the parent. If the foreign body remains in the ear for any length of time, the child may complain of deafness and irritation, with a desire to pick the ear. A diffuse inflammation of the canal may supervene, accompanied by severe pain.

Cases of obstinate cough, nausea and epilepsy are recorded as being due to foreign bodies in the ear. Moths and small bodies in the deeper part of the meatus may be hard to discover.

Treatment.—In the extraction of foreign bodies from the ear care should be taken to avoid injury to the canal and the membrana tympani. While extracting a foreign body from the ear the skin may frequently be torn sufficiently to cause bleeding. The meatus may be swollen and inflamed from previous efforts on the part of the patient or parent to extract the body. If the canal becomes swollen, one may be compelled to delay operative measures until the inflammation is reduced by hot irrigations. A fountain or large aural syringe should be used for irrigation. The water should be warm and directed, as far as possible, in the extraction of foreign bodies, to one portion of the canal. This method proving unsuccessful, a small curette may be gently passed behind the object, thus dislodging and changing its position, after which it may be removed with a blunt curette, goose-neck forcep or by irrigation.

Politzer speaks highly of the agglutination method of Lowenberg, which consists in drying the object with cotton and afterward inserting a camel-hair brush, previously dipped in glue, and applying it to the object.

In cases without inflammatory exudation, the brush may adhere with sufficient force to enable the object to be extracted. It is often necessary to administer an anesthetic in young children, on account of their resistance. Chloroform is more frequently used for narcosis. The anesthetic should not be carried to a state of complete narcosis. A child may be supported in the arms of the nurse or placed prone upon the operating table. With a head-mirror and light from lamp, candle or drop light, after partial narcosis, a blunt hook or straight curette may be pushed between the wall of the canal and the foreign body. As a rule, a single quick pull dislodges the foreign body. The ear should now be cleansed with a warm antiseptic solution, preferably lysol, one drachm to a pint of warm water, dried and dusted with stearate of zinc or aristol.

Live insects, when they reach the membrana tympani, cause most excruciating pain in the ear. It is frequently impossible to remove

the insect as a whole. After a few daily irrigations, small adherent particles of the insect will be washed away. Bugs may crawl into the ear, die without causing pain, afterward become covered with cerumen and are found when the cerumen is washed away. Live insects may be killed by blowing the fumes of chloroform into the canal. A convenient method of forcing the fumes of chloroform into the canal, is by saturating a pledget of cotton with chloroform and placing it in the bowl of an ordinary clay pipe, the stem of the pipe being placed in the auditory meatus and the fumes of the chloroform forced through the stem by blowing into the bowl of the pipe.

Cotton or gauze may be placed in the ear and forgotten. The author recalls a case in which the gauze had remained in the ear for fifteen years. The epithelium of the canal had exfoliated and infiltrated into the meshes of the gauze.

Larvæ may be removed, according to Politzer, by the instillation of oil or glycerin, to which is added a few drops of petrolatum, turpentine or ethereal oil. After a short time the larvæ crawl out of the meatus.

Disorders of Secretion of the External Auditory Canal.—The wax glands occupy about two-thirds of the auditory canal and are more numerous in the upper and outer portion. In health, the secretion is disposed of by evaporation and expulsion of wax by waving cilia of the canal and movements of the jaws in talking and eating.

Etiology.—Adults, more frequently than children, suffer from ceruminous plugs. Any constitutional disease, local irritation or catarrhal inflammation of the middle ear that may obstruct the free exit of cerumen or change the consistency of the secretion, may bring about impaction. Picking the ears with pins may cause an exfoliation of the skin, which, mixing with the glandular secretion, may cause the formation of a plug. Railroad men and factory men are predisposed to impacted cerumen, on account of the dust mixing with the ear wax. In washing the ear with soap and water, the patient will frequently force a sufficient amount of soap into the ear to start the formation of a plug. The consistency of the plug varies and is dependent upon the amount of moisture contained. It may be soft or hard and glistening, varying in color from a dark to a very light brown.

Symptomatology.—Sudden deafness, without any other symptoms, such as pain or vertigo, is suggestive of impacted cerumen.

Sea-bathing has a tendency to soften the wax which may be adherent to the canal, forcing it against the drum, which produces sudden deafness and pain in the ear.

A feeling of fullness and discomfort in the ear with more or less deafness and general nervousness and irritability, are suggestive symptoms. Among the nervous symptoms accompanying and sometimes dependent upon impacted cerumen, are cough, vertigo, hallucination, vomiting and facial paralysis.

Diagnosis.—There is usually no trouble in diagnosing impacted cerumen under good illumination from a head-mirror and the aid of an ear speculum. When the impaction is light in color and very hard, it may be mistaken for a morbid growth or keratosis obturans.

Prognosis.—There is always a tendency to a recurrence of the trouble. Many cases give a history of recurrence dating back many years.

If the impaction is due primarily to some mechanical irritation to the epithelium, prospects for a complete cure are very good. In young children in which the impaction is influenced by hypertrophied tonsils and post-nasal obstruction, a cure can only result after the complete removal of the obstruction in the nose and throat.

Treatment.—The treatment consists in the careful removal of the impaction by disintegrating with hydrogen peroxid, which is left in the ear for a few minutes, followed by a warm water irrigation.

The following is frequently prescribed to soften the impaction preparatory to irrigation:

℞ Sodii bicarbonatis, 1.30 gm. (gr. xx)
Glycerini, } āā 15.00 c.c. (āā ℥ ss)
Aquæ destili., }
M.

Signa. Drop three or four drops in ear, three times daily for from one to two days.

In irrigating the ear, the water should be at a temperature comfortable to the hand. A teaspoonful of bicarbonate of soda should be dissolved in a pint of warm water. In using the aural syringe or

irrigating tube care should be taken that the stream is thrown well into the meatus and in one direction. Too much force is to be avoided for fear of injuring the membrana tympani or producing syncope. After the ear wax is removed, the canal is dried with a fifty per cent. solution of alcohol, followed by the application of an unguentum of the yellow oxid of mercury (eight grains to the ounce) or dusted with iodol. The canal should be examined every two or three months to prevent a possible reaccumulation.

Deficiency of Secretion.—This is a condition of dryness of the auditory canal from insufficiency of ceruminous secretion, due to some trophic disturbance. Atrophy of the glands may occur from eczema of the canal, general inflammation of the canal or middle ear catarrh. The patient complains of a dryness in the ear, itching and a desire to pick the ears.

Treatment.—An ointment of yellow oxid of mercury, eight grains to the ounce of lanolin, may be applied to the canal once daily. The meatus may be gently massaged with an aural vibrator for a few minutes every other day for a few weeks. If complete atrophy of the glands takes place, the canal may be moistened every few days with an unguentum of yellow oxid of mercury.

Hyperemia of the Auricle.—Hyperemia of the auricle may be active or passive and is more frequently due to some vasomotor disturbance and quickly passes away. There is an increase of blood to the auricle, causing redness and a sensation of heat without exudation. Active hyperemia may result from friction, exposure to heat or cold, eczema or trauma. Hyperemia of the meatus may be due to inflammation of the tympanic cavity and surrounding tissue.

Passive hyperemia is chronic in character and is more often due to a stasis in the blood stream from valvular heart lesion or traumatism of the auricle. Other predisposing causes of passive hyperemia are certain forms of eczema, seborrhea, desquamation of epithelium and ulceration with the formation of scars.

Treatment.—For the relief of hyperemia of a purely nervous origin, treatment is directed to building up the debilitated nervous system and the correction of any constitutional dyscrasia. In hyperemia of the meatus due to inflammation of the tympanic membrane and

mastoid antrum, the treatment is necessarily directed to the cure of that disease.

Local treatment in passive hyperemia consists in gentle massage of the auricle and painting with a mild solution of the acetate of lead.

Traumatic Dermatitis of the Auricle.—Traumatic dermatitis is an inflammation of the skin covering the auricle, resulting from a blow, fall, bite of insects, irritating ear rings, telephone receiver, parasitic infection, etc.

Symptomatology.—The symptoms vary from a slight irritation of the skin, with redness and swelling, to a circumscribed cutaneous gangrene. There is more or less pain and feeling of fullness at the point of injury, varying according to the severity of the disease.

Treatment.—The treatment consists in the removal of the cause and the application of campho-phenique to the surface and afterward covering it with a thick roll of antiseptic cotton. A lead and opium wash is highly recommended in the mild form of the disease. Hot antiseptic poultices are indicated in the gangrenous form of the disease.

Dermatitis Erysipelatosa.—This form of inflammation of the auricle is due to infection from the streptococcus erysipelatosa of Fehleisen, which finds entrance into the surface from scratch, abrasion, cut, bite of insects, etc. The disease is more often secondary to a facial erysipelas, and may extend to and involve the membrana tympani or the middle ear.

Symptomatology.—The disease may be ushered in with a chill followed by high temperature, anorexia and headache. The auricle becomes red, swollen and glistening about the point of infection. The discoloration rapidly spreads over a part or the whole of the auricle. Vesicles, filled with a serous exudate, may form over a part or the whole of the auricle.

Treatment.—The infected area should be painted with pure carbolic acid and neutralized with alcohol. After applying the carbolic acid, sufficient time should elapse to allow a whitish discoloration of the inflamed surface to take place before the alcohol is applied. One application is usually sufficient to bring about a resolution. An

ointment of twenty per cent. ichthyol in lanolin is highly recommended as a cooling and antiseptic application.

Diet should be restricted and bowels regulated with calomel and aperient waters.

Dermatitis Phlegmonosa.—Dermatitis phlegmonosa is an infection spreading to the deeper structures of the auricle and is due to streptococcus erysipelatis, streptococcus or staphylococcus pyogenes.

Symptomatology.—There is a high fever, swelling and deep redness of the auricle, pain of a throbbing and beating character with the formation of pus, ending in suppuration and destruction of cartilage. Gangrene may sometimes supervene.

Treatment.—Hot antiseptic poultices are indicated in the beginning of the disease. As soon as pus is suspected from the swelling and palpation, a free incision should be made and perfect drainage established. The wound is afterward treated with hot antiseptic irrigation.

The debilitated system, which frequently precedes the disease, should be treated with general tonics.

Dermatitis Gangrenosa.—The various forms of this disease are seldom seen affecting the auricle. It may follow operation on the mastoid, from trauma or from frost-bite.

Treatment.—The treatment consists in the removal of necrotic tissue and an active effort to secure asepsis. In the early stages, warm stimulating applications are valuable in restoring circulation and metabolic change. The pain may frequently be controlled by dusting with aristol and orthoform, in equal parts. Isolation of the patient and sterilization of clothing, towels, dressings, etc., are demanded.

Dermatitis Congelationis, or Frost-bite.—On account of the exposed situation of the auricle and close attachment of the skin, want of subcutaneous fat and lessened blood supply, the auricle is predisposed to frost-bite.

Exposure to severe cold will bring about a contraction of blood vessels, anemia and numbness of the parts. If the severe cold is continued longer, the parts may be completely frozen, the auricle

remaining bloodless, and dry gangrene occurs. A portion or the whole of the auricle may separate at the line of demarcation.

After reaction, the vessels dilate, the tissue covering the cartilage swells and sometimes cracks open and the pain may be mild or very severe. Moist gangrene may occur.

Chilblain is a condition very closely allied to frost-bite and is an erythematous inflammation of the auricle due to cold. It is more often observed in children and those poorly nourished. Recurrent attacks occur with each succeeding exposure to cold weather. The symptoms of chilblain are itching and burning of the ears, produced by exposure to cold and sudden change to a warm room.

Treatment.—The treatment in frost-bite consists in the application of ice bags, snow or cold water to the auricle, allowing a gradual return to the normal temperature of the body. Should excoriation take place, the auricle must be thickly covered with benzoinated zinc ointment or ichthyol, one part to adeps benzoate seven parts.

If dry gangrene occurs, separation may be hurried by applying hot antiseptic poultices or by cutting necrotic tissue away and afterwards dressing with aristol and oiled gauze and protecting with cotton and bandages.

Dermatitis Combustionis or Burns.—In burns of the auricle, very often the neck is involved at the same time. Severe burns of the neck and ear may result from not infrequent accidents.

Treatment.—The object of the treatment is primarily to lessen the pain and prevent excessive connective-tissue formation. The dead and charred tissue should be removed at once. Peroxid of hydrogen is highly recommended as an antiseptic and cleansing agent. When the skin of the neck or auricle alone is involved, the parts should be cleansed with a solution of bicarbonate of soda and covered with the following:

℞	Zinc oxidi,	7.80 gm. (℥ ij)
	Orthoform,	3.90 gm. (℥ j)
	Adeps benzoinatis,	31.10 gm. (℥ j)

followed by a dressing of soft lint.

For superficial burns, equal parts of lime water and linseed oil

may be used. For the prevention of infection and pain, when the deeper structure is involved, Muench recommends ninety-five per cent. carbolic acid as a local application, which is immediately washed away with alcohol. The wound is afterward carefully dressed to prevent infection.

Eczema of the Auricle.—Eczema of the auricle is more often observed in children than in adults and is an acute, subacute or chronic inflammation of the skin of the auricle or meatus, characterized by itching or burning, with a catarrhal exudation and the formation of crusts or dry scaling of the skin.

Etiology.—Eczema of the auricle is more frequently associated with an acute or chronic purulent inflammation of the middle ear of children with a strumous or syphilitic diathesis. Not infrequently will it be found as an accompanying condition of acute myringitis, either in the young or in the adult, or extending from a seborrheic eczema of the scalp.

The disease may follow chronic irritation of the pinna or meatus, piercing of the ears, cheap ear-rings, frost-bite, irritating dust, iodoform dressing, constitutional dyscrasia, atmospheric conditions and excessive use of soap and water.

Pathology.—The disease is presumed to be a catarrhal condition of the skin closely associated with other forms of dermatitis, due to some extrinsic irritation, and subsides with the removal of the cause without leaving a scar.

Symptomatology.—The whole or part of the meatus or auricle, in the acute form of the disease, may be red and swollen and covered with a thick, moist crust, with here and there a leakage of serum through the skin. The skin has a tendency to crack open, especially at the floor of the meatus. There is itching and a desire to pick the ears. Frequently a chronic, purulent inflammation of one or both ears exists, with all the clinical symptoms of some inherited dyscrasia.

In the chronic form the disease varies greatly and may be limited to the meatus or involve the entire auricle. The skin may be reddened, dry, exfoliated and thick and smooth to the touch.

Diagnosis.—As a rule, the disease is very easily diagnosed. Differ-

entiation between syphilis of the auricle, erysipelas and dermatitis may be necessary.

Cause and Prognosis.—In the acute form of the disease, as a rule, the recovery is very rapid with the relief of the exciting cause. A chronic eczema of the auricle, associated with a like condition of the face, may continue indefinitely. If dependent upon a purulent otitis media, with inherited syphilis, the relief is sometimes quite magical under the iodids.

Treatment.—The treatment is first directed to the exciting cause of the disease. If a constitutional dyscrasia exists, a general treatment is indicated.

The local treatment consists in cleansing the surface of all accumulations and crusts by the local application of cold cream or oil, followed by a local application of nitrate of silver, sixty grains to the ounce of water. This should be applied once daily with some degree of force to the surface and cracks in the skin, followed by a local application of yellow oxid of mercury, eight grains to the ounce of lanolin.

For the relief of itching, W. A. Hardaway recommends the following:

℞ Phenol, 8.00 gm. (ʒ ii)
Glycerini, 15.00 c.c. (ʒ ss)
Alcoholis, 236.00 c.c. (ʒ viiss)
M
Signa. To be frequently mopped on the ear.

Jaquet recommends Thigenol, a compound of sulphur, as a sedative and antiseptic, in the following formulæ:

℞ Thigenol, 4.00 c.c. (ʒ i)
Zinci oxid, } āā
Amyli, } 3.00 gm.
Glycerini, } āā
Aquæ, } 1.00 c.c.
Ung. glycerini, 8.00 gm.
M
Signa. To be applied once daily.

As a rule, healing is encouraged by the avoidance of water to the ear.

Campho-phenique or vinegar of cantharides may be applied in full strength every two or three days, followed by the daily application of benzoinated oxid of zinc ointment.

When iron and sulphate of magnesia are indicated, the following is recommended by Hyde:

℞	Magnes. sulphat.,	60.00 gm. (ʒ ii)
	Acid sulphur. dil.,	8.00 c.c. (ʒ ii)
	Ferri sulph.,	.66 gm. (gr. x)
	Sodii chlorid.,	4.00 gm. (ʒ i)
	Cardamom. tinct. comp.,	4.00 c.c. (ʒ i)
	Aq. dest.,	256.00 c.c. (ad. Q i)

The general treatment must be governed by the character of the dyscrasiæ. The rules of personal hygiene should be enforced.

Lupus Vulgaris.—Lupus vulgaris is a chronic tuberculosis of the skin of the auricle, either primary or secondary to lupus of the face. The disease begins as a pin-head-sized, dull reddish or yellowish spot, deep in the skin, on a line with or elevated above the surface. The dull reddish nodules are sometimes years in developing. The growth becomes soft and "apple-jelly-like," as described by many authorities. After a time the tubercles or lupoma undergo absorption or degeneration, thus presenting all the varieties of the disease.

Course.—The course of the disease is exceedingly chronic. A part or the whole of the auricle may be involved. After absorption of the lupoma, the auricle becomes shrunken and deformed.

Diagnosis.—The diagnosis is made by the history of tuberculosis in the family, origin of the disease in early life, reddish brown, "apple-jelly-like tubercles," and chronicity of the disease.

It may be necessary to differentiate the disease from eczema, syphilis, blastomycetic dermatitis, acne rosacea or epithelioma.

Treatment.—The general treatment consists in securing good hygienic surroundings and the administration of cod liver oil or iodid of potassium and Fowler's solution of arsenic.

The local treatment consists in the evacuation with a sharp spoon or dermal curette, as advised by Volkmann, Hardaway and others. The guarded application of the X-ray is recommended by many. The X-ray should be applied from eight to ten minutes every other

day. In the London Hospital, all cases of lupus are treated with the Finsen light. Those cases which have not been curetted better respond to the light, and in healing, leave little or no scar.

Impetigo Contagiosa.—Impetigo contagiosa is an acute contagious disease of the skin, beginning as small discrete or confluent vesicles, "sometimes developing to the size of a twenty-five cent piece" (Hardaway). The disease may attack the nose or auricle primarily or may spread to the nose or auricle from contiguous parts. Impetigo contagiosa is more especially within the domain of the dermatologist; on account of the ear involvement, however, space is given to the disease.

Pathology.—So far, no specific organism has been discovered as a cause of the disease. Its transmission from one individual to another suggests some contagious organism.

The lesion begins in one or more discrete or confluent vesicles, which rupture and leave a dry, granular surface resembling, as remarked by Hardaway, vaccinia. The disease may occur at any age.

Diagnosis.—The disorder may be differentiated from eczema, by history, course, presence of slightly umbilicated vesico-pustules, which, drying, leave flat granular crusts, and by the contagiousness of the disease.

Prognosis.—Recovery usually results within a few days, when a strict treatment is instituted.

Treatment.—The surface should be cleansed with a solution of surgeon's soap and lysol, one drachm of the latter to a pint of hot water and soap, twice daily, followed by a local application of ammoniated mercury and lanolin in equal parts.

Acquired Syphilis of the Auricle.—The pinna may become primarily infected by kissing, injury in foot ball, scratch of a pin or bite.

Secondary and tertiary stages will be more frequently encountered.

Diagnosis.—The primary lesion, or hard chancre, may be observed, and is a small ulcer with hard indurated base and edges appearing a few weeks after the injury. The period of incubation is considered twenty-one days, varying, however, from ten days to two

months. The initial lesion more frequently conforms to the papular type.

The lesion is governed by the character of the trauma and may be formed as a fissure, ulcer, or an erosion. However, the base hardens with the growth of the induration.

Ulcerations frequently manifest themselves about the lobe and the meatus of the ear. The lymph glands of the neck are swollen.

The secondary period of the disease may occur as a general syphilodermata, limited to a portion of the body.

The diagnosis is, as a rule, easy. However, it is very necessary that the diagnosis be perfectly clear before antisyphilitic treatment is begun.

The tertiary lesion may appear as a gumma or an ulceration, located on the anterior or posterior surface or on the lobe.

The diagnosis of a gummatous ulceration of the auricle, in the absence of a history of syphilis, is frequently difficult. It may resemble lupus, epithelioma or blastomy cosis.

Treatment.—The treatment of syphilis of the auricle varies in no wise from syphilis in any other portion of the body. (See Treatment of Syphilis of the Nose.)

Congenital Syphilis of the Auricle.—(See Syphilis of the Nose.) Syphilis of the auricle may be observed as a secondary or tertiary lesion. Lesions of the ear frequently accompany a like condition of the nose and eyes.

In a case observed by the author, the disease was in a child two years old, associated with a chronic, purulent otitis media. The eruption around the auricle and meatus resembled eczema. Brownish crusts covered the surface. The inflammation and purulent discharge from the ear reacted quickly to small doses of mercury and the iodid of potassium.

It is interesting to know at what age, approximately, after birth, are we to expect indications of inherited syphilis. Dr Prince A. Morrow, in his valuable work on syphilography (p. 632), says:

"An important question comes up, as whether the indications of an inherited disease appear immediately at, or after birth, and, if the latter, how soon after. At one time the belief was current that

syphilis was manifest at birth or a few days subsequent. But further investigation shows that, while this is true in a large majority of cases, many instances occur in which the manifestations of syphilis are delayed for several months. Roger (*Union Medicale*, 1865) collected two hundred and forty-nine cases from several sources; Diday, one hundred and fifty-eight; De Meric, twenty-eight; Mayer, forty-nine; Rogers, fourteen. In two hundred and seventeen of these, syphilis appeared before the end of the third month and in thirty-two cases it came later. Sifting these cases still closer, it will be seen that, although a very large percentage occur in extra-uterine life, there were several cases in which the manifestations of the inherited disease were delayed long beyond the usual three months. Thus, in Diday's cases (Syphilis des Nouveau-Nes), syphilis appeared before the first month in eighty-six cases; before the second month in forty-five cases; before the third month in fifteen cases; at the fourth month in seven cases; at the fifth month in one case; at the sixth month in one case; at the eighth month in one case; at the twelfth month in one case; at the twenty-fourth month in one case. Of these one hundred and fifty-eight cases, syphilis appeared in one hundred and forty-six before the end of the third month, leaving twelve cases in which the outbreak of the disease was delayed till later. Taking these one hundred and forty-six cases in which syphilis appeared before the expiration of the third month, it was found that eighty-six of them took place before the end of the first month and one hundred and thirty-one before the end of the second month."

According to Morrow, there are three periods in the life of the subject of inherited syphilis, at which the disease is likely to appear: birth, puberty and at the close of middle life.

Diagnosis.—The diagnosis of inherited syphilis is by a process of exclusion. The general condition of the mucous membrane of the nose and other portions of the body, with ulceration and the formation of a crust over the lobule of the ear and general debilitated condition are all suggestive diagnostic signs of the disease. A further diagnostic sign is the persistency of the disease and failure to respond to other than antisyphilitic treatment.

Treatment.—The treatment consists in inunction of mercury or mercury by the mouth in the early stages of the disease. In the later stage, the mercury should be combined with iodid of potassium.

The personal hygiene of the child, as a rule, demands warm salt-water baths, out-door exercise, clean underclothing and nutritive diet.

The local treatment consists in antiseptic washes and the application of some stimulating ointment, preferably the yellow oxid of mercury, ten grains to the ounce of lanolin.

Herpes of the Auricle.—Herpes is an affection of the skin, characterized by the formation of one or more vesicles filled with a clear serum, due to some nervous disturbance.

Symptomatology.—The vesicles appear singly or in groups about the lobule or over the helix, accompanied by fever, slight pain, heat and itching over the auricle. The skin is red, swollen and tender to the touch.

The course of the disease is very short, the vesicles, in the mild form of the disease, being absorbed at the end of two weeks without leaving a scar.

Diagnosis.—A sudden appearance of clear, whitish vesicles on the surface of the ear, with redness and burning, suggests the disease.

Treatment.—The febrile symptoms may be treated with purgatives and antiseptics. The surface should be washed twice daily with hot water and dusted with stearate of zinc or anointed with oxid or zinc salve. It is frequently advised to open the vesicles if they become purulent, after which the surface may be dusted with calomel or aristol. Hypodermic injection of morphia may become necessary should the pain and burning become severe.

Otomycosis or Mycosis of the External Auditory Canal.—This is a parasitic inflammation of the external auditory meatus, usually due to the aspergillus niger flavescens, fumigatus and trichothecium roseum. The disease frequently accompanies a chronic inflammation of the external auditory canal (Fig. 87), and may be due, as observed by Würdeman, to getting water in the ears, especially from bathing in fresh water lakes, many of which contain vegetable matter and spores.

Symptomatology.—The disease begins with the symptoms of a general otitis externa, with itching, tinnitus and pain. If the canal is much obstructed from accumulations of the parasites, there will be more or less deafness.

Diagnosis.—The surface of the meatus appears to be covered with a whitish mass sprinkled over with brownish or black plaques. After the removal of the whitish mass, the skin appears red and indurated.

Treatment.—The treatment is directed to cleansing the canal

FIG 87.—ASPERGILLUS NIGER: HEADS WITH CONIDIA. + 600. (After *Siebenmann and Hovell.*)

with alcohol and 1/1,000 bichlorid solution in equal parts, followed by a dusting powder of stearate of zinc. Maurin recommends application twice daily of a solution of permanganate of potassium 1/1,000 to 2/1,000, and reports twenty-four cases cured by this method. Oxygenated water, twenty per cent., is recommended as a daily application. Otto J. Stein especially recommends a two to five per cent. solution of formalin on gauze strips, and sealing with collodion.

Perichondritis.—Perichondritis is an acute or chronic inflammation of the perichondrium of the auricle, due to direct trauma or operation on the mastoid.

Symptomatology.—In the acute form, there is redness and swelling of the skin and pain extending deep into the meatus. After exudation takes place, the parts are uneven and fluctuating. The exudation may first resemble a serous fluid, later becoming purulent.

Course.—The disease is sometimes very protracted, ending in deformity of the auricle. Ossification of the auricle may subsequently occur, as in the case of Knapp, referred to by Politzer.

Treatment.—In the early stages of the infection, iced applications to the auricle are indicated and should be continued for twenty-four hours. After that time, moist or dry heat should be applied. As soon as fluctuation is discovered, the parts should be incised and any necrotic cartilage removed.

The subsequent treatment consists in warm irrigation once daily, dusting with aristol, packing in oiled cotton and application of a pressure bandage.

Chronic perichondritis is a chronic inflammation of the cartilage of the auricle from repeated irritations, observed in boxers and wrestlers.

The treatment of chronic perichondritis is directed to the removal of the irritation, dry heat and the antiseptic dressing of any excoriations of the surface.

Cholesteatoma of the External Auditory Canal.—This is a desquamative process of the epidermis lining the external auditory canal, occurring as a primary or secondary disease and characterized by the formation of scale-like epithelial cells arranged in layers containing cholesterin. Sometimes the disease may occur secondary to a purulent inflammation of the external auditory canal or middle ear. The masses filling the canal are then cheesy-like, foul smelling and bathed in pus.

The disease occurring secondarily to a chronic purulent inflammation of the middle ear, may extend to and involve the middle ear and accessory cavities. In the primary form, the disease may also extend to the middle ear or to the mastoid cells by pressure, which

destroys the osseous wall or membrana tympani, causing a disintegration of normal structures.

Symptomatology.—Pain, tinnitus and deafness, in proportion to the amount of pressure in the canal, with sometimes a purulent discharge from the ear, are some of the symptoms. In extension of the disease to the middle ear and mastoid, there may be headache, dizziness and nausea, with symptoms of inter-cranial involvement.

Diagnosis.—In the primary form, layers of glistening epithelial cells will be seen firmly adherent to the canal, differing thus from simple exfoliations of the epithelium, or eczema. Microscopically, the scales are made up of horny cells or squamous epithelium without a nucleus.

In suppurative conditions of the middle ear, chloesteatomata may be seen extending through the perforation in the drum or found in small clumps in the pus exuding from the meatus. The canal may be partially or completely occluded with the epithelial formation.

Treatment.—The treatment is directed to the removal of the cholesteatomatous masses from the canal by softening with hydrogen peroxid and afterwards irrigating with a warm, antiseptic solution. A small blunt curette may be necessary to a complete removal of the scaly masses.

The cure of any suppurative complications in the middle ear and mastoid process is necessary to a complete cure. The attic may sometimes be freed of cholesteatoma by irrigation with a Blake middle ear syringe and daily application of a fifty per cent. solution of alcohol.

Acute Circumscribed External Otitis or Furuncle.—A furuncle is an acute circumscribed inflammation of the external auditory canal, due to infection from the staphylococcus pyogenes.

Pathology.—The organisms find entrance through the hair follicles or sebaceous glands and, on account of trauma produced by picking the ears or instrumentation and feeble resisting power of the tissue, a local inflammation is produced, which frequently ends in a circumscribed necrosis. The cocci may spread to other follicles along the surface or through the lymph channels. With the destruction of the hair follicles and surrounding connective

tissue, a core is formed, which sloughs away, leaving a granulating surface.

Course and Symptomatology.—On account of the closely adherent skin, pain is usually violent in character, throbbing and beating and extending over the temples and to the throat and teeth. The pain is aggravated by eating and talking and is more severe at night. The disease runs its course in from five to ten days. The severity of the disease is variable in individuals, depending upon the intensity of the infection and resistant power of the tissue, violent cases ending in suppuration.

Diagnosis.—The diagnosis of the exact location of the area of infection, on account of the swelling of the surrounding tissue and the inability to place the speculum, is sometimes very difficult. The disease may be associated with acute otitis media, acute myringitis or diabetes.

Treatment.—If seen early, effort should be made to abort the attack by vigorous purging, cold applications and painting with campho-phenique or salicylic acid and collodion. The canal should be freed of any debris by syringing with hot solutions of corrosive sublimate, 1/5,000. Sack, of Moscow, recommends cleansing the auditory canal and a tamponade of carbolated glycerin, tightly filling the canal, in the early stages of the disease. Randolph, of Baltimore, recommends a two per cent. salicylic acid ointment, to every ounce of which is added fifteen drops of carbolic acid. The tampon saturated with the ointment is changed every day. The treatment is continued even after incision for the relief of pus, as an antiseptic. Leeches to the distended parts are often indicated. After the disease has advanced, hot applications must be made in the form of bags of hops, salt, Japanese hot-box, cleansing with peroxid of hydrogen, and controlling the pain with hypodermic of morphia, internal administrations of calcium sulphid, two to five grains in combination with benzoate of soda, ten grains, three times daily. Haug recommends that gauze saturated with acetate of aluminum be placed in the canal to abort the disease. Where there is great pain, he recommends the placing of gauze soaked in three to ten per cent. alcohol solution of anesthesin. Any accumulation of pus should be evacuated by

making a deep incision with a cataract knife; incisions should be avoided, however, as much as possible. The canal should be carefully treated antiseptically, for the reason that so long as the staphylococcus pyogenes is present on the surface or in the epithelium, a recurrence of the condition in any portion of the canal is probable. Tonics and alteratives are usually indicated for a few weeks after the onset of the disease.

Chronic Circumscribed External Otitis.—Chronic circumscribed external otitis is a localized area of chronic inflammation, following a like acute condition due to an extension of infection from the surface to the deeper tissue, especially involving the sebaceous glands.

Treatment.—The treatment is directed to the free incision of the sebaceous cysts with the curettement of the contents and the lining membrane, followed by daily cleansing of the canal and tampon of gauze saturated in twenty per cent. aqueous solution of ichthyol.

Otitis Externa Crouposa.—This is an acute inflammation of the external auditory canal, characterized by a croupous exudation, described by Wilde, Bezold and others, and may be associated with otitis media or otitis externa.

Symptomatology.—There is violent pain in the ear, slight fever and tinnitus, with the formation of a yellowish-white exudation over the bony portion of the canal and tympanic membrane.

Diagnosis.—The exudation, examined microscopically, is composed of coagulated fibrin. There may be a like exudation over the tonsils. It is easily detached and afterward frequently recurs. The disease runs its course in a few days and terminates favorably.

Treatment.—This consists in the removal of the exudation with a cotton-tipped probe and dusting the canal with trypsin. The patient should be instructed not to pick the ear for fear of causing a double or mixed infection.

Otitis Externa Diffusa.—This is a general inflammation of the external auditory meatus and may be produced by a diffusing of the circumscribed form of the disease, pyogenic microörganisms, foreign bodies in the canal and trauma. The disease may accompany a purulent inflammation of the middle ear with perforation of the drum.

Symptomatology.—As a rule, the disease begins with severe pain

in and about the ear, fever, with redness and swelling of the skin covering the meatus, scaly exudation, followed in a few days by a serous or viscid exudation upon the surface. In the deep or phlegmonous form, there is swelling and edema of the osseous portion with hyperemia of the drum and pain about the auricle and mastoid, tinnitus and deafness.

Pus filled with desquamated epithelium and micrococci fills the osseous portion of the canal. The odor from the canal is usually offensive. According to Hovell, abscess may form in the membrana tympani, causing perforation.

Course.—In its milder form, the disease may run its course in from three to four days, ending in complete recovery. In the severe form, a chronic purulent inflammation may follow. Not infrequently granulations form on the posterior and superior walls of the canal, which, if neglected, may produce cicatricial bands and atresia.

Diagnosis.—It is frequently difficult, on account of the swelling of the canal, to differentiate a general inflammation *a priori* from middle ear disease. The pain, history of inflammation in the canal, and tenderness assist in arriving at a correct diagnosis.

Treatment.—Exudations in the canal should be removed with hot lysol douches, one-half drachm to the pint of water, followed by the careful removal of desquamated epithelium with cotton-tipped probe. Where there is marked swelling of the canal, dry heat may be applied. Dry heat applied with a Seely or Beck instrument is highly recommended. Argentum nitrate, twenty grains to the ounce of water, may be applied to the surface, followed by dusting with iodol or stearate of zinc. A deep incision, with antiseptic precautions, into the swollen canal may be necessary to relieve the engorged subcutaneous tissue.

Granulations of the auricle can be touched lightly with trichloracetic acid, twenty per cent., or touched with a sixty grain to the ounce solution of nitrate of silver.

The discharge may become chronic after the cessation of the acute symptoms. Stricture of the canal may follow ossifying periostitis or adhesion of the walls of the canal.

The general treatment is directed to a correction of any constitu-

tional dyscrasia or lowered vitality, mild purgation with calomel, followed by a saline, and morphia hypodermatically, if the pain is severe.

The use of alcoholic liquor should be dispensed with, on account of the tendency to increase the uric acid condition of the blood and hyperemia of the canal.

Otitis Externa Diphtheritica.—This is an acute inflammation of the meatus, characterized by the formation of a necrotic membrane due to the bacillus of diphtheria. Irritation of the meatus is presumed to be essential to infection.

Symptomatology.—The disease seldom originates primarily in the meatus and is more often due to an extension of a like condition of the fauces. The external auditory canal may be found involved during epidemics of diphtheria.

The disease begins with a marked constitutional reaction, pain in the ear and the formation of a whitish or grayish-white exudation, which adheres to the wall of the canal. When detached, the surface of the meatus is perceived to be excoriated and bleeding.

In primary diphtheria, the meatus is exceedingly tender to the touch, the surrounding tissue being red and swollen. The cervical lymphatics are swollen from the absorption of toxins and are tender to the touch.

When the disease is secondary to a like infection of the middle ear there is an absence of pain. In this form of the disease the prognosis, according to Bruhl, is less favorable than in primary diphtheria of the meatus.

Course.—The disease may run its course in a few days. There is a gradual detachment of the membrane and healing of the ulcerated surface. However, the membrane may remain adherent for a number of days and when detached, quickly reform. The ulcers and excoriations of the surface may be obstinate in recovery, frequently forming sloughs, resulting in stricture of the canal.

Diagnosis.—The clinical diagnosis of the disease is dependent upon the history of an epidemic of diphtheria, pain in the ear, adherent grayish membrane and bleeding surface upon detachment of the membrane. The bacteriological examination of the exudation shows the bacillus of diphtheria.

Treatment.—The constitutional treatment differs in no wise from that of diphtheria of the throat.

The local treatment consists in irrigating the canal with lime water or 1/1,000 bichlorid of mercury solution and dusting with trypsin. One-tenth per cent. perchlorid of iron in glycerin is highly recommended as a local application. The patient should be isolated and all cotton and gauze used about the ear should be burned.

CHAPTER XII.

DISEASES OF THE MIDDLE EAR.

Injuries of the Membrana Tympani.—Injuries of the tympanic membrane are direct or indirect. Direct injuries of the membrana tympani may be due to foreign bodies accidentally or maliciously being forced into the middle ear. Politzer reports two cases of Shafer, in which molten iron and lead were forced into the auditory canal. A sudden condensation of air within the auditory canal by a blow in boxing or slapping the side of the face and ear, frequently ruptures the drum. Explosions of heavy fire crackers, artillery or rifle fire may produce rupture of the drum by increasing atmospheric pressure within the canal.

Schade reports the case of a nineteen-year-old merchant who swallowed a bent nail. Twelve days later the patient suffered severe otitis media. Three days afterward the nail was removed through the auditory canal. It was twelve mm. long and one mm. thick.

Caisson workers, divers and balloonists are predisposed to rupture of the drum from change of air pressure.

Injury to the drum head may result from fracture of the skull, contre-coup or by irradiation as shown by Aran.

The author recalls a case of indirect rupture of the drum in an officer of the American army, while on target range at Matanzas, Cuba. After firing a Krag-Jorgensen a number of times from the right shoulder, he complained of pain, ringing and roaring in the left ear. Upon examination, a complete rupture of the drum was observed, extending through the posterior half of the drum.

Pritchard reports a case of fracture of the handle of the malleus by indirect force.

Gunshot wounds of the mastoid or temporal bone may produce rupture of the drum by jarring and increased atmospheric pressure within the auditory canal.

Symptomatology.—The subjective symptoms of rupture or injury of the drum, are pain, vertigo, tinnitus aurium, deafness and slight hemorrhage from the canal. After rupture of the drum, the hearing is seldom completely restored. Sometimes the patient is unable to distinguish the direction of sound; however, during the process of healing, this condition gradually passes away.

The objective symptoms are slight hemorrhage from the canal and if the injury is produced by a blunt or sharp instrument there may be more or less injury to the wall of the canal. The drum is very red and there is usually more or less blood at the rupture, varying according to the character of the injury. If a sharp instrument has passed into the brain there may be an escape of cerebro-spinal fluid.

Treatment.—The treatment for both the direct and indirect injuries is quite the same. Prevention of infection is the *sine qua non* in the treatment of injury of the tympanic membrane.

The canal should be carefully mopped dry with a cotton-tipped probe dipped in a two per cent. solution of lysol or a twenty per cent. solution of alcohol, dried and tamponed with antiseptic gauze. Providing no infection takes place, healing of the drum is usually very rapid. Partial deafness may result.

Injuries of the Eustachian Tube.—Injuries of this character may result from the forcible passage of bougies, from stab or gunshot.

Camerer reports a case in which a blade of straw was forced through the Eustachian tube into the middle ear. The orifice of the tube may be injured in curettement of the vault of the pharynx leading to partial stenosis.

Treatment.—The treatment is directed to the careful inspection of the tube, the extraction of the foreign body and spraying the nose with a warm alkaline and antiseptic solution. Should the middle ear become involved, the treatment will be the same as for acute otitis media.

Hyperemia of the Membrana Tympani.—Hyperemia of the drum membrane may be active or passive and is a vaso-motor disturbance due to a local or general irritation. The severity of the hyperemia is dependent upon the cause. If the irritation is continued for any length of time, inflammation may result.

Among the exciting causes of hyperemia are exposure to cold winds, acute coryza, massage of the auricle and membrana tympani, injury of the drum from sudden condensation of air in the auditory meatus and some pathological irritation within the middle ear or external auditory canal.

Ecchymosis, or rupture of a small blood vessel, may occur from mechanical irritation, sudden rarefaction or condensation of the air in the external auditory canal. Upon inspection of the drum, the membrane will vary in appearance from a mild pinkish discoloration about the periphery to a deep reddish discoloration of the entire drum. The blood vessels following the handle of the malleus appear distended and very red. Even with great discoloration of the membrana tympani, the blood vessels covering the malleus may be increased in size and small anastomosing branches may start out from the periphery.

Symptomatology.—The symptoms vary from a mild itching in the canal to a severe pain. Patients frequently suffer severe pain in the ear from hyperemia induced by exposure to cold winds.

Treatment.—The treatment is directed to the removal of the cause, which may be due to local irritation, constitutional dyscrasia or occupation. Hyperemia produced by firing guns or heavy artillery may be partially controlled by placing cotton in the ears. For the immediate relief of hyperemia, a twelve and one-half per cent. solution of carbolic acid in glycerin should be dropped into the ear two or three times daily, followed by the application of dry heat for fifteen to twenty minutes. The disease has a tendency to disappear spontaneously without producing any structural change in the drum.

Acute Myringitis.—As the name implies, this is an acute inflammation of a part or the entire structure of the tympanic membrane due to some form of infection.

Etiology.—The greatest cause of inflammation is some form of trauma, induced by bathing, acute coryza, picking the ears and instillation of oils, followed by infection from some pathologic organism.

Symptomatology.—The disease is usually ushered in by pain in the ear, which increases in severity, feeling of fullness in the ears, tinnitus aurium and rise of temperature. Inflammation of the outer layer

is more frequently observed. With the increase of the irritation, the outer layer may become distended from a serous or a bloody infiltration, followed by rupture of the dermic layer. A general ulceration may occur from the spread of infection and even abscesses may form in the deeper layer. According to Politzer, an abscess at the point of infection may appear reddened and ecchymotic, resembling a pustule encircled by a red areola. The symptoms in the severe form increase in intensity until a rupture of the dermal layer takes place, with the discharge of serum from the canal.

In the milder form of the disease, the pain lessens in a day or two, and the serous exudate is absorbed. Following acute myringitis without rupture, on account of the slowness of the absorption of the exudate, the drum may remain thickened with marked reduction of the hearing.

In the severe form of the disease, the irritation passes away in a few days, with or without complete restoration of the transparency of the drum and hearing power.

Prognosis.—On account of the varied changes which may occur in the drum during the progress of the inflammation and the possibility of atrophy or hypertrophy which sometimes follow, the prognosis, unless in the very mild form, is necessarily guarded.

Pus may break through in the middle ear, causing acute otitis media, with the formation of a perforation in the drum. Cicatrices and calcareous deposits sometimes form permanently, altering the normal movements of the drum.

Diagnosis.—In many respects, the disease resembles acute otitis media. In acute myringitis, on auscultation there is a wide blowing sound, indicative of a normal Eustachian tube. In the mild form of the disease, the hearing is usually normal, differing in this respect from acute otitis media.

Treatment.—Rest in bed, free purgation with calomel, followed by magnesium sulphate, Kutno's powder or Hunyadi water is indicated. For the relief of the local symptoms, twelve and one-half per cent. carbolic acid in glycerin should be instilled every half hour into the ear, with the head gently turned to the opposite side, followed by dry heat in the form of hot-water bottle or Japanese hot-box.

If blebs are detected, they should be incised under antiseptic precautions, followed by flushing the ear with a hot lysol solution, one-half drachm to a pint of hot water.

For the relief of the pain in the beginning of the inflammation, it may be necessary to administer one-eighth to one-quarter of a grain of morphia hypodermatically.

After rupture of the blebs, the ear should be irrigated twice daily with lysol solution, after which it is dusted with aristol. To prevent additional infection reaching the already infected area, cotton should be worn in the meatus.

The absorption of the fibrinous exudate into the drum may be encouraged, after the acute symptoms have passed away, by application of dry heat and gentle massage of the drum and inter-tympanic inflation with the fumes of camphor, menthol and iodin.

Chronic Myringitis.—Chronic inflammation of the membrana tympani more often follows an acute attack. When there has been a previous rupture of the drum, the disease is closely allied to acute otitis media.

Symptomatology.—The patient complains of a sense of fullness and irritation in the ear of the affected side, tinnitus and more or less deafness. The discharge from the ear is exceedingly variable in quality.

The discharge covering the drum and floor of the canal may be scanty and can be detected by passing a cotton-tipped probe into the meatus. The odor from the discharge is sometimes very offensive. Staphylococci are frequently found in abundance. The color of the drum, where there is no discharge, is a whitish yellow, the short and long processes are obscured and the drum is observed to be slightly bulging outward. The drum head may be covered by granular excrescences, varying in size from a pin-head to a pea, which may occur singly or in groups and resemble small polypi.

Diagnosis.—As in the acute form of the disease, the freedom of the Eustachian tube and middle ear involvement is ascertained by inflation and auscultation, likewise the presence or absence of a perforation is established. With a cotton-tipped probe under good illumination, the drum may be cleansed of any debris and the condi-

tion of the drum exposed to view. Microscopic examination of the secretion and pus, which is frequently present, as a rule, shows the presence of staphylococcus. The odor of the secretion may be very offensive. A perforation of the drum may be one of long standing and should be differentiated from an acute rupture.

Prognosis.—The disease runs a slow course and rarely ends in a complete restoration of the drum to the normal. The drum may become hypertrophied with deposits of calcareous matter, when there will be reduction of hearing.

Treatment.—The secretion may first be loosened from the membrana tympani by the application of four or five drops of peroxid of hydrogen, followed in a few minutes by irrigation with a warm solution of lysol, one-half drachm to a pint of water.

The canal is dried with a cotton-tipped probe and any remaining debris removed.

Camphoroxal in fifty per cent. solution of sulphate of zinc, ten grains to one ounce of a fifty per cent. solution of alcohol, may be applied three times daily with a dropper. The ear should be cleansed daily by irrigation until recovery is complete.

The excessive usé of alcoholic liquors is interdicted and any constitutional dyscrasia must be corrected.

Granulations on the drum may be destroyed by the application of a twenty per cent. solution of nitrate of silver or a fifty per cent. solution of chromic acid.

Acute Catarrh of the Middle Ear.—Acute catarrh of the middle ear is an acute inflammation of the mucous membrane of the middle ear, characterized by a catarrhal exudation.

Etiology.—The causes are both predisposing and exciting, and are syphilis, so-called catarrhal diathesis, unhygienic surroundings, gastro-intestinal disorders, insufficient clothing, uric acid diathesis, irritating gases, scarlet fever, measles, pneumonia, small-pox, typhoid fever, tuberculosis, operations within the nose and throat, cauterization of the posterior turbinated bodies, exposure to cold, hypertrophied lower turbinated bodies, acute naso-pharyngitis, adenoids, enlarged tonsils, bad teeth and pathogenic micrococci. Subacute coryza, hypertrophy of the lower turbinated bodies and adenoids

are probably the three most important factors in the causation of acute catarrh of the middle ear.

Pathology.—The disease is more often due to a primary involvement of the Eustachian tube and is characterized by swelling of the mucous membrane of the Eustachian tube and middle ear, engorgement of blood vessels and transudation of serum and a few leucocytes, exfoliation of broken down ciliated epithelium and exudation of mucus from the goblet cells of the epithelium. The organisms more frequently associated with the catarrhal process are the diplococcus pneumoniæ, bacillus tuberculosis, pneumo-bacillus of Friedländer, staphylococcus cereus albus, the bacillus pyocyaneus and the micrococcus tetragenus. Suppuration seldom occurs, the disease ending in resolution and absorption of the exudation.

Symptomatology.—The symptoms are somewhat variable. Pain may be entirely absent or quite severe. The patient complains of fullness in the ears, autophony, tinnitus, deafness, cold in the head and naso-pharyngitis. The hearing may be improved somewhat in eating, gaping and swallowing. There is a desire to massage the ear with the finger as though to remove some obstruction within the ear. There is usually a rise of temperature, especially in young children. In adults, mental depression accompanying inflammation of the Eustachian tube and middle ear is often quite profound. The drum membrane loses its luster and is contracted or slightly bulging with mild hyperemia of the periphery of the drum and along the handle of the malleus. Where the symptoms are more intensified, there is a general hyperemia of the drum head and with the exudation of serum into the middle ear, the color of the drum changes to a yellowish-white.

Diagnosis.—The diagnosis is made both by the objective and subjective symptoms, the improvement of hearing upon inflation and the detection of rales by auscultation.

Course and Prognosis.—The disease usually runs its course in from one to four weeks, ending either in a complete restoration or a permanent alteration in hearing. The earlier the recovery the less is the liability to the formation of adhesive bands. The prevention of recurrence and the supervention of a subacute or chronic catarrh

of the middle ear is dependent upon the early removal of the cause.

Treatment.—The involvement of the Eustachian tube being frequently the greatest factor in the causation of the disease, attention is directed to the establishment of free permeability of the tube. Any engorgement of the mucosa of the nose should be reduced by the application of a two per cent. solution of cocain in adrenalin, 1/5,000, followed by the application of the same solution directly to the ostium tuba, with a curved cotton-tipped probe. The nose and throat are afterward carefully cleansed by spraying with a warm Dobell's solution. If there is present an acute naso-pharyngitis, a four per cent. solution of the chlorid of zinc or a four per cent. solution of the nitrate of silver, should be applied once daily high up into the vault of the pharynx with a curved applicator. The patient should spray the nose and throat frequently with a Dobell's or Seiler's solution. For the pain in the ear, a twelve and one-half per cent. solution of carbolic acid and glycerin may be instilled, while warm, into the ear. Heat, in the form of a hot-water bottle, may be applied to the ear for one-half hour, every three hours. In the early stages of the disease, in the adult, ten grains of Dover's powder, combined with twenty grains of benzoate of soda may be given at bedtime. Children should be given a graduated amount of Dover's powder and benzoate of soda. The patient should be instructed to remain quietly at home until resolution is established. Prophylactic treatment consists in the enforcement of personal hygiene, cold tub baths upon arising, well ventilated sleeping apartments, out-door exercise and the removal of the predisposing cause of the disease.

Inflation of the middle ear by the Politzer method or the Eustachian catheter is frequently necessary to an early restoration of the patency of the tube and the prevention of adhesive bands in the tube and middle ear. This should be done once daily after the stage of congestion has passed away. Upon failure of the exudation to disappear after a week, the drum should be incised and the secretion forced out of the middle ear by inflation and gentle aspiration with a Siegle's otoscope. Frequently, strings of mucus may be sucked out of the middle ear and Eustachian tube with a catheter and Polit-

zer bag. A fine nebulous spray of camphor, menthol and iodin in albolene may be forced into the middle ear through the Eustachian catheter, following inflation. This form of treatment is especially efficacious and well borne. Vibratory massage about the auricle, during the stage of resolution, aids in promoting absorption of exudates.

Subsequent treatment is directed to a cure of any boggy lower turbinates or subacute catarrhal inflammation of the nose, which are often present. Post-nasal catarrh, adenoids and tonsils should be removed. Small, unoffensive-looking tonsils are frequently as great an irritant as large ones. Cold tub bath, upon arising, is one of the greatest prophylactic measures that can be prescribed.

CHAPTER XIII.

DISEASES OF THE MIDDLE EAR—CONTINUED.

Chronic or Hypertrophic Catarrh of the Middle Ear.—This is a chronic non-suppurative disease of the middle ear, characterized by exudation, deafness and structural changes in the mucous membrane. The disease is frequently associated with a like condition in the Eustachian tube, nose and naso-pharynx.

Etiology.—Among the many predisposing and exciting causes of this disease are exanthematous diseases, adenoids, hypertrophied tonsils, chronic nasal catarrh, syphilis, climatic conditions, over-indulgence in tobacco and alcoholic liquors, inherited catarrhal predisposition and recurrent attacks of acute nasal catarrh, simple acute otitis media, and heredity. Von Troeltsch was the first to call attention to heredity as a cause of progressive deafness. He believed that inherited peculiarities in the structure of the skull, congenital narrowing of the naso-pharynx and Eustachian tube, shallowness of the tympanic cavity, and faulty structure in and about the labyrinthine windows, all predispose to adhesive catarrh and catarrhal hypertrophy of the mucous membrane of the Eustachian tube and middle ear.

The changes in the middle ear are frequently due to a primary disease of the Eustachian tube. Alteration in the lumen of the Eustachian tube from disease interferes with complete ventilation of the middle ear and, in consequence, the membrana tympani is driven inward and a passive hyperemia is produced.

Pathology.—In the hypertrophic or moist form of the disease, there is a swelling of the cells of the parts, increase of blood supply and exudation of serum and mucus, which is sometimes visible through the membrana tympani. The mucosa may be involved either in its entirety or with certain limitations. Frequently the mucous membrane covering the ossicles and middle ear becomes

involved. The swollen mucous membrane about the ossicles becomes adherent from the fibrous exudation, permanently binding the ossicles. The same condition extends to the tympanic membrane and floor of the middle ear. Progressive alteration of the gland structures and connective tissue elements may occur, producing the hyperplastic or dry catarrh of the middle ear.

Symptomatology.—The disease may manifest itself at any age, though more frequently in youth and middle age. One or both ears may be affected, the left more frequently than the right. The sexes are equally liable to the disease. A permanent deafness in one or both ears may follow an acute inflammation of the ear. Frequently deafness of one side is of slow progress and is only discovered by accident, the patient unconsciously accommodating himself all the while to the gradual change. Progressive deafness is usually the one symptom that causes the patient to consult the physician. A cracking sensation in the ear in swallowing or blowing the nose may be one of the early symptoms of the disease and is caused by air being forced through the mucus as it passes in and out of the Eustachian tube. The patient complains of tinnitus, especially in well-advanced cases of the disease. Sounds in the ear may be continuous or intermittent and occur at long or short intervals. Parcusses Willissii may be present. The patient complains of an increase of deafness and fullness in the ears on exposure to damp weather and attacks of acute coryza. Upon inspection, the tympanic membrane appears to be dull and opaque, with sometimes a deposit of lime, especially in patients of a tubercular or uric acid diathesis. Around the periphery may be observed an opacity resembling the arcus senilis of the cornea. There is usually retraction of the drum and posterior of the short process of the malleus. The long process may occupy the normal position or may be drawn up somewhat horizontally. The membrana flaccida may be hyperemic or grayish in color and retracted. The cone of light may be diminished or entirely absent. In atrophy, the drum will be wrinkled and transparent and when the middle ear is injected with air, small bulging areas may appear on the outer or posterior quadrant and frequently in Shrapnell's membrane. With the Siegle's otoscope, the drum

will be completely or only slightly movable. The movements may be entirely confined to Shrapnell's membrane. The immobility of the drum is especially due to the thickened bands of connective tissue binding the drum to the ossicles and the inner wall and ankylosis of the ossicles. Where there is an absence of ankylosis, the malleus will be seen to vibrate upon suction with the otoscope.

The Eustachian tube is usually affected at the same time and is swollen and partially or completely occluded by adhesions, accumulations of múcus and hypertrophy of the mucosa. The caliber of the Eustachian tube varies distinctly in damp or cold weather; the patient complains at this time of a fullness in the region of the Eustachian tube, mental depression and ringing in the ears. Gaping, widely opening the mouth, swallowing and pulling the lobe of the ear forward will be indulged in frequently by the patient, in the vain effort to restore the patency of the Eustachian tube. In stenosis or closure of the Eustachian tube and middle ear, an increase of hearing usually follows Politzeration or inflation through the Eustachian catheter. Upon salpingoscopy or inspection of the ostium tuba with a Fränkels rhinoscope, the condition of the ostium tuba is discernible. In the early stages of the disease, the mucous membrane about the ostium will appear swollen and covered with a viscid secretion. As the disease becomes more chronic, the mucous membrane of the tuba appears pale and shrunken and covered with an exudation, especially along the floor of the tube.

The disease is frequently progressive in character and more especially so in patients subject to recurrent attacks of coryza, which is more often due to a chronic hypertrophy of the lower turbinated bodies either in the anterior or posterior portion. Under favorable treatment, the deafness frequently becomes stationary or even improves. The most favorable cases for treatment are those in which the structural change is in the Eustachian tube rather than in the middle ear.

In the Weber test, the bone conduction will be more distinct on the affected side providing there is no disorder of the labyrinth. If both sides are affected, the bone conduction will be more distinct on the side in which the deafness is more pronounced.

The Rinne test is partially or completely negative. The watch will be heard through the mastoid when there is no involvement of the labyrinth.

Speech, whisper and watch tests will all show marked disturbance of the hearing.

High pitched musical tones and words will be more distinctly heard than low tones. The patient complains of inability to catch certain low tones, and in the confusion of words, while in conversation with a number of people, the ears may suddenly open up and the hearing be quite restored for a short time. The patient may hear better in a loud noise, due to the movement of the inflexible auditory ossicles which cause the auditory nerve to be set in motion (Politzer).

Course and Prognosis.—The course of the disease is usually slow. Treatment may cut short the progress of the disease and even bring about a marked improvement. Frequently the disease continues to grow worse, producing partial or complete deafness. Recurrent attacks of acute coryza and acute salpingitis, predisposing catarrhal diathesis and syphilis render the prognosis unfavorable. Improvement of hearing, upon Politzeration or catheterization, may be considered a favorable sign.

Diagnosis.—The diagnosis with the foregoing enumeration of symptoms in chronic moist catarrh of the middle ear and Eustachian tube is comparatively easy. Upon auscultation, the character of the rales will aid in differentiating the disease from chronic myringitis. The disease may be differentiated from sclerosis of the middle ear by symptoms which will be enumerated under that subject.

Treatment.—In the treatment of secretive middle ear catarrh, some form of inflation of the Eustachian tube and middle ear is indicated, either by the Politzer method or through the Eustachian tube. The Politzer method must be used in children. (See Politzer Method, p. 115). A great many operators object to the inflation of the middle ear by means of the Eustachian catheter, believing that the point of the catheter necessarily brings about trauma of the ostium tuba and predisposes to inflammation and hypertrophy. Randolph with many others believes that catheterization is the

most valuable of the mechanical methods in the treatment of chronic middle ear catarrh.

Where the Eustachian tube is much swollen about the isthmus, the catheter is required to force air into the middle ear. The frequency and length of treatment with the catheter depends upon the progress of the case. As a rule, inflation should be used every other day. After a few months' trial, provided the patency of the tube is normal, negative results should contraindicate the use of the catheter. If air is forced into the tube from an air cut-off, it should be filtered and the pressure should not exceed twenty pounds. Intervals of rest from inflation, in chronic cases, should be recom-

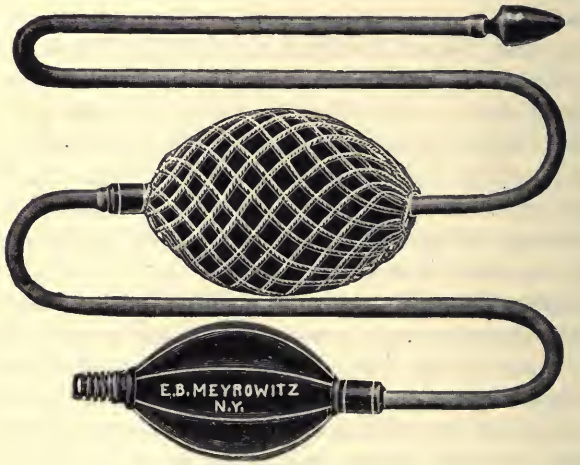

FIG. 88.—ACHSCHARUMOW'S DILATOR FOR THE EUSTACHIAN TUBE.

mended. Inflation of the ear may be induced by puffing out the lips and forcibly injecting air through the nose at the same time, as in the Politzer method. This method is especially recommended in the treatment of children.

Dr. Achscharumow's method for dilating the Eustachian tube is favorably mentioned by Dr. D. B. St. John Roosa. The directions for its use are as follows:

"When used by the patient himself, the two air bags (Fig. 88) are placed upon the table with the tubing. The nose-piece is then adjusted to one nostril and the other closed over with one hand so as to be absolutely air-tight. This being done, with the other hand pressure is made upon the air bag No. 1, for say a dozen times or even more, until the second or reservoir bag is well distended. Rapid pressure is made upon it, care being taken at the same time not to omit keeping the olive-shaped nose-piece well in the nostril and closed over so that it may be air-tight. There seems to be no ill effect from the use of this apparatus for some minutes twice daily. In certain cases of chronic swelling of the tube, with consequent want of proper ventilation of the tympanum, it seems for self use at least to be preferable to Politzer's apparatus, but just how much its value is, remains as yet unsettled." (*The Post Graduate.*)

Medicated vapors are recommended where the mucus persists in the Eustachian tube and middle ear. The vapors of chlorid of ammonium are highly recommended for dissolving the exudates. Instruments for generating the chlorid of ammonium gas may be had at any instrument house. The vapors may be applied for two or three minutes twice weekly. A convenient method for the injection of medicated vapor is with a Dench middle ear vaporizer. In children and those in whom the Eustachian catheter cannot be used, a few drops of drugs, which easily evaporate, such as chloroform, ether, turpentine or iodin, may be dropped into the Politzer bag, and the air thus charged with the vapor may be injected by the Politzer method. In chronic catarrh, the direct application of fluids through an Eustachian canula, to the Eustachian tube and middle ear is decidedly dangerous. The reaction which follows may accentuate the disease. Advisedly speaking, fluids should only be injected into the middle ear when there exists a perforation of the drum.

A graduated amount of fluid may be injected into the Eustachian tube through the catheter. Among the solutions recommended are bicarbonate of soda, two to three grains to the ounce of water, chlorate of potash, two to three grains to the ounce of distilled water, sulphate of zinc, two grains to the ounce of water, nitrate of silver,

one to three grains to the ounce of water, iodid of potassium, five grains to the ounce of water.

Warm, sterilized, medicated albolene, preferably a two per cent. camphor-menthol solution, may be used with freedom in the Eustachian tube and middle ear. Ten to twenty drops may be injected into the catheter with a syringe. With the Politzer bag or compressed air, a few drops may be sprayed into the middle ear. This form of medication is especially efficacious when there is swelling in the tube.

Rarefaction of air in the external auditory canal as recommended by Delastanche, is valuable in selected cases (see Massage, p. 136). In cases where there is a perceptible vibration of the drum, malleus and membrane, judiciously applied massage will increase the blood and lymph supply to the parts and aid in breaking up adhesions in the ossicular chain. Massage is contraindicated or of little value when the vibration is confined to Shrapnell's membrane. Frequent massage is contraindicated in young children, on account of the possibility of causing atrophy of the drum.

The removal of the membrana tympani and ossicle for the relief of chronic catarrhal deafness is, as a rule, a very unsatisfactory proceeding because of the marked cicatricial adhesions which subsequently follow. Temporary relief may follow the operation, though after a short time the patient becomes very much worse. The division of the tensor tympani muscles, first performed by Weber-Liel, is recommended when there is great retraction of the drum, but, as a rule, the results are unsatisfactory. Staphedectomy and partial resection of the drum are also recommended. However, results are again very unsatisfactory.

Plicotomy, or incision of the posterior fold, is a simple operation and is highly recommended by a few, for the relief of the subjective symptoms.

Lucæ pressure (see Fig. 139) probe is especially recommended to aid in breaking up adhesions in the ossicles. The instrument should be made directly over the short process of the malleus and for a few seconds every three or four days.

Vibratory massage with a pneumatic aural vibrator, applied to

the meatus and about the auricle once daily, is pleasant to the patient and of some value as a stimulant, especially following inflation of the middle ear.

The high frequency current may be applied directly to the meatus and the membrana tympani, the warmth of which will aid in stimulating the absorption of fibrinous exudations. It should be applied once daily for a period of from ten to fifteen minutes and continued until sufficient time has elapsed to demonstrate its value. The nose, naso-pharynx and throat should be carefully inspected for any pathological changes. A spongy condition of the lower turbinated bodies is frequently present in patients with a history of recurrent attacks of coryza and closure of the Eustachian tube. Adenoids or remnants of adenoids and hypertrophy of the tonsils predispose to the disease. Perfect nasal breathing is distinctly essential to free ventilation of the middle ear. With this in mind, the first step in the treatment is the removal of all obstructions in the nose, naso-pharynx and pharynx, which may possibly affect the functions of the Eustachian tube. The immediate good of such radical measures may not be apparent, but after a few months or a year, the patient usually observes a lessened susceptibility to colds and freedom of the Eustachian tube and middle ear from the annoying fullness, tinnitus and ever-consciousness of irritation in the ear. Alkaline washes are indicated for the relief of any catarrhal inflammation. Excessive use of tobacco and alcoholic liquors is interdicted. For hypertrophy of the ostium tuba and increased glandular secretions, fifty per cent. argyrol solution should be applied once daily with a curved, cotton-tipped probe, to the mouth of the tube. The probe should remain inserted in the tubal opening for five minutes.

A hard-rubber filiform bougie may be dipped in a solution of argyrol in the above strength and passed through a large catheter up to the isthmus of the Eustachian tube. The bougie not only carries enough of the silver salt to the mucous lining of the tube, but tends to break up any stricture of the Eustachian tube. The bougie may be dipped in argyrol solution and allowed to dry, after which it is passed into the tube and allowed to remain for five minutes or until the argyrol is dissolved. The whale-bone bougie or bougies

made of silk-worm gut are used. The bougie is passed through a large silver catheter into the middle ear, care being taken that the drum is not punctured. The bougie should be marked approximately the length of the tube. Care should be exercised to prevent traumatism of the mucosa in passing the bougie. In the normal Eustachian tube, the bougie is passed into the middle ear without friction and with little distress to the patient. Where a stricture cannot be probed without great pressure, the electrolytic bougie of Duel is indicated.

Chronic Adhesive Catarrh of the Middle Ear, Otitis Media, Catarrhalis Sicca or Sclerosis of the Middle Ear.—Chronic adhesive catarrh of the middle ear is the antithesis of chronic, hypertrophic catarrh of the middle ear and is characterized by the formation of new connective tissue within the middle ear subsequent to a chronic, hypertrophic inflammation or to a localized, interstitial inflammation. As a rule, the disease is intractable in character and ends in partial or complete deafness.

Etiology.—The important factor in the etiology of the disease is recurrent accentuations of chronic, hypertrophic, aural catarrh; less frequent factors are hereditary predisposition, atrophic rhinitis, general sclerosis of the air passages, syphilis, Bright's disease, rheumatic diathesis, excessive use of tobacco and alcohol, paralysis of the palate muscles going to the Eustachian tube, and lastly, an inherent susceptibility of the mucous membrane and blood vessels to undergo sclerosis, induced by causes unknown.

The disease occurs more frequently in the middle aged and the old and is usually bilateral and more pronounced in the left than the right ear.

Pathology.—According to Politzer, the changes in the mucous membrane may be localized or diffused, the localized form resulting from interstitial inflammation and the diffused form from chronic, moist catarrh of the middle ear. There is a complete change of the round-celled infiltration into fibrous connective tissue which may subsequently become sclerosed with calcification of the membrana tympani and sometimes the mucous membrane, with atrophy and destruction of the glandular structures.

According to Politzer, four pathological stages of the disease may be apparent.

1. When the secretory stage is still in progress we have hyperemia and irregular swelling of the mucous membrane which is yellowish or bluish-red in color. There is a proliferation of round cells, swelling of the substantia propria and formation of connective tissue. The Eustachian tube becomes narrowed, the mastoid cells and antrum become edematous and with the diminution of the size of the tympanic cavity from infiltration of succulent connective tissue, the stapedo vestibulæ ligament becomes involved with bending down of the foot plate and total immobilization of the ossicles.

2. When the secretion has totally ceased from a complete change of the mucous membrane into connective tissue, we have the mucous membrane pale, smooth, thickened and closely adherent to the underlying bone, thus binding tightly the ossicles and rendering rigid the mucous membrane and ligaments supporting the ossicles. The membrana tympani may not be disturbed or it may be put on the stretch or retracted, finally undergoing atrophy in places, becoming thin and transparent. "The annular ligament of the stapes may become absorbed and the stapes imbedded in the oval window from a process of osteitis."

3. Striæ and bands of membrane running in various directions connecting the ossicles, the membrana tympani and the tensor tympani muscle are, according to the author quoted above, not always pathological processes but may be residue of the fetal mucous membrane cushion.

4. The fourth condition is one in which the membrana tympani is adherent to the inner wall of the tympanic cavity, produced by the transformation of excessively proliferated mucous membrane into connective tissue with the obliteration of the middle ear and the formation of exostosis.

The changes about the rotund window are the same as those in the tympanic cavity and, according to Politzer, the niche is filled with connective tissue covered with a villous growth and sometimes adipose tissue.

Fixation of the stapes may be due to fixation of the malleus and

its indrawing, to the formation of the adventitious bands as enumerated above, to the general sclerosis, to bony ankylosis of one of the crura to the side of the vestibule or to fixation of one side of the foot plate to the oval window from bony sclerosis.

According to Richard Lake (*The Journal of Laryngology*, July, 1906) true osseous fixation of the stapes is relatively rare and probably only occurs under one of two conditions, either rarefying osteitis of the labyrinthine capsule, or as a result of chronic suppuration in the middle ear.

The pathological change in the mucosa and underlying structures of the Eustachian tube is the same as in the middle ear, the tube becoming sclerosed and extremely patent. Changes in the labyrinth may also occur and are due to sclerosis of the blood vessels and to inflammatory deposits about the oval window and extending into the labyrinth.

Symptomatology.—The patient complains of progressive deafness, sensations of fullness in the head, mental apathy, subjective sensations in the ear, usually accentuated in bad weather, unsteadiness of gait, frequently paracusis Willisii and sometimes pain in the ear, giddiness and a tendency to a marked mental depression. The patient can frequently hear sounds but not words in ordinary conversation.

Diagnosis.—The auditory canal is usually free from cerumen and the walls dry and parched. The appearance of the membrana tympani is variable, it being slightly contracted, grayish and thickened, with total absence of the light spot. Where partial atrophy has taken place, the drum appears thin in spots and quite transparent with a tinting of the membrane from the hyperemic inner tympanic wall. The drum may also appear irregular and unevenly stretched. Shrapnell's membrane may be thin and deeply pitted.

Sometimes circumscribed or semilunar calcareous spots are present, appearing more often in front of the handle of the malleus. The periphery of the drum may appear densely white, thus resembling the arcus senilis of the cornea.

With Siegle's speculum, anterior or posterior quadrant may be seen to vibrate; however, the vibration is variable and may be ob-

served only in Shrapnell's membrane or a small portion of the drum.

The malleus is also variable in appearance and may be retracted and very indistinct with partial or complete obliteration of the unbo.

In examination, the nose and naso-pharynx in simple, uncomplicated sclerosis, may appear dry and glistening with dilated nasal fossæ. There is usually a like pallor and glistening of the naso-pharynx and orifice of the Eustachian tube. In the early stages of the disease the nasal mucosa appears swollen and of a deep red color with follicular formations on the pharyngeal wall.

Upon auscultation, the Eustachian tube will show moist rales with partial occlusion of the tube. In the advanced stages of the disease, the tube is open and the air forced through the catheter is loud, blowing and free from interruption. Inflation shows little or no improvement in the hearing. Watch and whisper test shows marked diminution in the hearing. The Weber test, in the early stages of the disease, is positive and is lateralized to the side most diseased provided there is no labyrinthine lesion present. However, as the disease progresses, the test correspondingly decreases in value.

With a set of tuning forks, there is a loss of low notes and likewise a diminution in perception of high tones through the air. Marked diminution of bone conduction is indicative of labyrinthine disease.

Rinne test in the early stages of the disease may give a positive result but in the advanced stages it becomes negative.

Galton whistle shows diminution in upper tone limit. Galle test is negative where the stapes are fixed in the oval window. Bing's test No. 2 shows little or no improvement in the entotic test (see page 117).

Provided the ossicles are not entirely rigid and the stapes sealed in the oval window, the hearing is aided by the use of the ordinary speaking tube and is wonderfully accentuated by the use of the audiphone which is a fan-shaped disk of vulcanized rubber, applied to the teeth.

Course and Prognosis.—As a rule, the disease is progressive in character, usually ending in partial or complete deafness. If taken

in the first stages of the pathological change, the course of the disease may be cut short by appropriate treatment. Those cases in which the hearing is only slightly reduced with little or no tinnitus and slight increase of hearing upon inflation, may be considered favorable.

The majority of cases that come under observation are those in which the sclerosis is well advanced and ankylosis complete and, in consequence, treatment is of little or no value.

The prognosis is unfavorable in those cases suffering from Ménière's symptoms and in which inflation through the Eustachian catheter does not increase the hearing. Operative measures are usually contraindicated. The removal of the ossicles or membrana tympani has so far proven of no value to the author.

Treatment.—The treatment is both local and constitutional. The constitutional treatment is directed to the correction of any diathesis which may influence the disease, correction of any condition which might predispose to a sclerosis of the upper air passages and the protection of the body against bad weather and a tendency to contract cold in the head.

In the early stages, the local treatment is directed to the relief of any irritation in the nose, nasal space and Eustachian tube. Inflation with the Politzer bag or Eustachian catheter should be given every other day until all evidence of improvement has ceased. Stricture of the tube can usually be relieved by inflation, and if too dense, resort must be made to hard rubber or electrolytic bougie.

Many solutions are recommended as an injection for the promotion of absorption of adventitious bands. The following is highly recommended by Lake:

℞	Red iodid of mercury,	gr. iv,	.24 gm.
	Lanolin,	ʒ ¾,	2.40 c.c.
	Parololeine,	ʒi,	30. c.c.
M			

Sig. A few drops to be injected into the middle ear, followed by otomassage.

Politzer recommends, in the adhesive stage of the disease combined with swelling of the Eustachian tube, the tubal injection of

five to six drops of a one to two per cent. solution of pilocarpine, also the fumes of sal ammonium and turpentine vapors. Hot, medicated air is recommended by Lermoyez and Mahu.

In the early stages of the disease, oto-massage is of special value; however, as the disease progresses, results from this form of treatment are unsatisfactory.

Thiosinamine, one to three grains after meals, is indicated for the absorption of the fibrous bands and if continued for a long time, is very efficacious in many cases.

Lucæ's pressure probe is frequently of value where there is a drawing inward of the membrana tympani.

Improvement is seldom permanent in character and in consequence, patients should not continue treatment week after week especially where no improvement is noted, but should allow a few weeks or months to elapse before renewing the treatment, which should cover a period of from two to three months.

Stricture of the Eustachian Tube.—Stricture of the tubes is often due to a swelling from a catarrhal inflammation of the middle ear or the naso-pharynx. Small connective tissue bands varying in thickness and size are observed. The site of the stricture is more often in the cartilaginous portion. The caliber of the tube is demonstrated by auscultation. If the stricture is due to fibrous bands and not to simple swelling, repeated applications of the bougie and an inflation with superheated air may promote the absorption of the new tissue and restore the patency of the tube. Failure by this method will necessitate the use of electrolysis.

Insulated Eustachian catheters especially constructed for this work are to be had at any instrument house. The gold electrode of Duel is attached to the negative pole and carefully passed through the rubber-covered catheter until it strikes the stricture, when the current is gently turned on: the positive pole to the neck, the strength being three to five ma. There is no pain accompanying or immediately following this treatment. The treatment should be continued weekly until relief is secured. The Eustachian tube should not be inflated immediately after the electrical treatment.

The internal treatment in chronic catarrhal deafness is directed

to building up the system and the correction of any constitutional dyscrasia. Thiosinamine is highly recommmended by a few, in one-half grain doses three times daily, to promote absorption of exudation, hypertrophy and adhesions in the mucosa. In larger doses the drug causes headache and vertigo.

Simple Acute Otitis Media.—Simple acute otitis media is an acute inflammation of the mucous membrane of the middle ear, due to thermic or chemic agent or a mild form of infection, in which there is seldom any destruction of the tissue or perforation of the drum.

Etiology.—The disease frequently results from some local disturbance of nutrition, acute or chronic naso-pharyngitis, acute coryza, exanthematous disease, typhoid fever, whooping cough, fluids forced into the ear by blowing the nose, sea bathing, nasal douche, turbinectomy, tonsillotomy, cauterization of the lower turbinated bodies, etc. Any one of the above conditions may directly or indirectly alter the function of the tubal epithelium and epithelium lining the middle ear and induce the symptoms of inflammation independent of pathogenic organisms. Injury of the epithelium of the middle ear and Eustachian tube may permit pathogenic microörganisms to reach the middle ear and produce the disease. According to Grunert, it is probable that some forms of otitis are due to a hematogenous infection. The disease is more often observed in children than in adults and is, according to Klug, Lermoyez and others, considered a contagious disease.

Pathology and Symptomatology.—Following local injury and infection from thermal, chemical or bacterial agents, there is a swelling of the mucous membrane of the middle ear and infiltration of leucocytes, which produce an edema or an exudation into the middle ear cavity. The exudation is serous or fibrous in character and later on may contain blood-cells, pus, epithelial cells and microörganisms. In addition to the swelling and exudation, we have heat, pain and partial loss of hearing. The pneumococcus is the most frequent organism found as the exciting cause of the disease (Nadoleczny). The streptococcus pyogenes follows next in frequency. In addition, infection may occur from the staphylococcus

pyogenes aureus and albus, bacillus pyocyaneus, bacillus coli and other microörganisms.

Resolution frequently takes place without a perforation of the drum. The mucous membrane of the Eustachian tube and middle ear is predisposed by the disease to hypertrophic changes.

The patient complains of a fullness in the ears, deafness, tinnitus aurium, autophonia, subjective noises in the ear, sometimes pulsating in character, and quite frequently, acute coryza.

Itching about the drum and a tendency to pick the ears, followed by severe throbbing and aching pain in the ear, which is continuous and accentuated at night, are some of the symptoms. The ear symptoms frequently follow an acute coryza or naso-pharyngitis and the forcing of water into the middle ear while bathing. The severe pain, which lessens somewhat after the stage of exudation, may cause a rise of temperature and even convulsions in children. An elevation of temperature, headache and general malaise may accompany the disease in adults.

Course and Prognosis.—The course of the disease is somewhat variable and depends upon the cause and tissue resistance. The pain continues from a few hours to a number of days. With the absorption of the exudation, the discoloration and swollen condition of the drum passes away. Provided the drum has not ruptured there is a complete amelioration of all the symptoms in from one to two weeks.

Recurrent attacks or prolonged subacute inflammation predispose to the formation of adhesive bands in the middle ear and a hypertrophic catarrh of the middle ear and Eustachian tube.

Treatment.—In the beginning, the treatment is directed to the alleviation of the severe pain in the ear. For this, three or four drops of a ten or fifteen per cent. solution of cocain may be dropped into the ear every hour, after which the meatus auriculæ is sealed with cotton dipped in collodion.

Andrews recommends three to four drops of a twelve and one-half per cent. soluiton of carbolic acid, warmed, to be instilled into the canal every fifteen minutes until the pain is relieved. Dry heat in the form of hot water bottle or hot flannels should be applied con-

tinuously to the ear as hot as can be conveniently borne by the patient. The method of Bier is highly recommended by Keppler and others, wherein the disease is often aborted by congestive hyperemia and the active symptoms quickly disappear. In the Bier method, the neck is constricted, not too tightly, with a rubber bandage one inch in width. This is continued twenty-two hours out of the twenty-four. There is produced a hyperemia of the face with slight swelling and edema. It is presumed that the edematous fluid forced into the inflamed area will lessen bacterial activity and promote absorption of morbid exudation. The local swelling at first increases, soon to be followed by a recedence of the symptoms. Paracentesis should always be performed when indicated, so that pressure may be prevented and free drainage established.

In the Bier treatment, after twenty-four hours, the use of the bandage should be discontinued, or it should be used advisedly, if there is no relief from pain, or change in the character of the pus, from a thick to a thin and milky consistency.

According to Randolph, the drum should be incised as soon as the other measures for relief of the pain have failed and more or less bulging of the drum is present. The free evacuation of pus should be encouraged by the application of dry heat.

Following paracentesis, the ear should be irrigated twice daily with a warm solution of lysol, one-half drachm to the pint of water.

After the active inflammation has subsided, a mild astringent may be instilled into the ear, following irrigation and drying with cotton.

℞	Zinci sulphat.,	.36 gm. (gr. vi)
	Acid boracic,	.90 gm. (gr. xv)
	Alcoholis,	4.00 c.c. (ʒ i)
	Aq. destill., q. s. ad.	30.00 c.c. (ʒ i)
M		

Signa. Four or five drops in the ear twice daily.

The nose and naso-pharynx should be sprayed or mopped with a two per cent. solution of cocain, followed by an application of adrenalin chlorid, 1/1,000, to the mouth of the Eustachian tube once or twice daily.

The patency of the tube and middle ear is quickly restored after the congestion has slightly subsided, by Politzeration or by the use of the Eustachian catheter. A continuous current of superheated air, forced through the Eustachian catheter for a few minutes daily, is highly recommended. When the pain is intense, three or four leeches should be applied to the front of the tragus. Leeches should not be applied in anemic or diabetic patients. One-eighth to one-quarter doses of morphin may be given to adults and a much smaller dose to children when the pain cannot be controlled by local treatment. Aconite may aid in aborting the attack. This should be given every hour in one drop doses until there is a tingling sensation in the tongue which is indicative of the constitutional effect of the drug. Rest in bed and a soft diet should be followed by the internal administration of benzoate or salicylate of soda in ten grain doses three times daily and calomel in one-tenth grain doses hourly until free purgation results.

The nose and throat should be sprayed three or four times daily with a warm Dobell's or Seiler's solution.

The patient should guard against exposure to cold and damp weather and imperfect protection of the body after convalescence is established. Cold tub baths upon arising should be recommended to patients with a catarrhal tendency. In children the neck and chest should be sponged with cold water at the morning bath as a substitute for the cold bath. Personal hygiene must be impressed upon the patient as in all affections of the upper air passages. Constitutional treatment is recommended in debilitated patients. When the exudation within the middle ear is slow of absorption, vibratory massage applied to the external auditory canal for a few seconds each day will aid in stimulating the blood supply to the parts and absorption of the exudation. Adenoids and hypertrophied tonsils or any abnormal obstruction should be removed and the patient taught the faculty of normal nasal respiration.

Paracentesis or incision into the membrana tympani is, when indicated, performed under very rigid rules of antisepsis. The external auditory canal is irrigated with a solution of lysol, one drachm to a pint of warm water, or a one-half per cent. solution of

carbolic acid to which has been added a small amount of biborate of soda. In the absence of a large aural syringe, an ordinary fountain syringe may be used for irrigation. The reservoir of the syringe should be elevated two or three feet above the head. The nozzle of the syringe is placed well up into the meatus and a pus basin or bowl is placed against the auricle in close apposition with the cheek and neck. The ear is dried with pledgets of cotton on a probe following the irrigation.

Paracentesis may be performed with but little pain to the patient where there is marked distention of the drum, but a local or general anesthetic is necessary in the greater number of cases. With the head of the patient resting upon the opposite side, a fifteen per cent. solution of cocain dropped into the auditory canal will bring about a local anesthesia in about ten minutes.

Equal parts of carbolic acid, menthol and alkaloid of cocain is a favorite combination for bringing about anesthesia of the drum. Three or four drops are instilled into the canal or applied directly to the drum with a small pledget of cotton.

Anesthesia is practically complete after five or ten minutes. The membrana tympani should be completely exposed to view by the aid of a head-mirror, ear speculum and natural or artificial light. A right-angle paracentesis knife may be used for incision or puncture of the drum. With the speculum in position and under careful illumination, the point of the knife is carried to the site of the bulging of the drum, the drum is punctured by gentle pressure and the incision carried downward to the floor of the canal, following the curve of the periphery of the drum. The drum is very thin and transparent and is easily punctured. With this in mind, care should be exercised to prevent the point of the knife cutting too deeply into the inner wall and puncturing the internal ear.

Paracentesis is much more difficult in children than in adults. A long needle may be used in the absence of a suitable knife. Following paracentesis, the canal should be cleared of blood and any serous exudate with a cotton-tipped probe and afterward tamponed with a strip of sterilized gauze for drainage and the prevention of infection entering the canal. Dry heat should be immediately applied to

the ear to encourage exudation and the alleviation of pain, which frequently continues for a few hours.

Acute Otitis Media Purulenta.—Acute otitis media purulenta is an acute purulent or muco-purulent inflammation of the mucous membrane of the middle ear, due to infection.

Etiology and Pathology.—According to the researches of Preysing and Hassleur, the middle ear is free from bacteria. On account of the natural immunity and the anatomical position of the tympanum, inflammation follows from an extension of infection through the Eustachian tube, lymph or blood stream.

Bezold and Rudolph have shown that there is always a middle ear inflammation accompanying measles. Diphtheria of the throat may involve the middle ear by extension from continuity of tissue. According to Levin, the toxins of diphtheria circulating in the blood may also produce inflammation of the middle ear.

Among the predisposing causes of middle ear inflammation are acute coryza, influenza, acute and chronic naso-pharyngitis, syphilitic dyscrasia, tubercular diathesis, exanthematous disease, typhoid fever, enlarged tonsils and adenoids. The tubal epithelium is presumed to prevent infection from reaching the middle ear, however, any traumatic or chemical agents which may injure the epithelium will predispose to the disease.

Acute otitis media of the new-born and otitis media of nurslings are of profound interest on account of the great number of cases that are unrecognized or receive no attention from the parent or physician.

Out of the sixty-five cases examined at post-mortem by Ponfick, dying under one year of age of diphtheria, scarlet fever, inflammation of the lungs, purulent meningitis, gastro-enteritis, furunculosis and erysipelas, only seven had normal ears. There is still some doubt as to the exact etiology of middle ear inflammation in the new-born. It is argued by some that the disease is due in a great measure to the entrance of the amniotic fluid into the middle ear and the failure of this to be absorbed after birth brings about the formation of pus. Other investigators believe the microörganisms enter the middle ear in the new-born with mucus of the naso-pharynx and, on account of the want of resistance of the mucous membrane of the middle

ear from embryonal influences, bring about an acute inflammation.

Ponfick calls attention to the nutritive disturbances of the system which are due to the absorption of toxins eliminated from the infection of the middle ear. Pus drains more readily into the throat from the middle ear of infants than in adults, on account of the shortness of the Eustachian tube, and necessarily brings about gastro-intestinal disorders upon entering the stomach.

The milk decomposes quickly, the patient refuses nourishment and rapidly becomes emaciated.

Grunert tersely puts the proposition to the physician when he says, "That every nursling with general symptoms, with intestinal disease, with catarrhal disease of the lungs, with diseases of nutrition, etc., should have its ears carefully examined, even when no symptoms on the part of this organ seem to indicate an examination of the same."

The variety of microörganism found in otitis media is quite the same in infants and adults. The severity of the disease is dependent upon the power of resistance of the tissue and the microörganism producing the infection. As a rule, infection is mono-bacterial in all acute inflammation of the middle ear. Polybacterial infection may follow rupture of the drum and exposure of the middle ear to organisms already in the canal or to those which may subsequently find lodgment therein.

The organisms which most frequently bring about suppuration in the middle ear and in the order of their frequency, are the streptococcus pyogenes, pneumococcus, staphylococcus aureus and albus, typhoid and tubercle bacilli.

Symptomatology.—Acute otitis media in infants may run its entire course without any conspicuous symptoms other than the cachexia and general catarrhal condition of the child. In severe cases of acute inflammation of the middle ear, the child cries constantly, turning its head from side to side and sleeping only when completely exhausted or under the influence of opiates. The restlessness of the patient ceases only with the cessation of the inflammation or rupture of the drum. The infant may suffer from high fever

and sometimes delirium and the symptoms of a meningeal affection before the spontaneous rupture of the drum or paracentesis.

Patients old enough to express themselves complain of severe throbbing and beating pain in the ear, which radiates to the teeth and throughout the head and is continuous. Movements of the jaws while talking and eating and pressure on the tragus aggravate the pain in the ear.

The disease frequently comes on at night and the patient is awakened with a severe pain in the ear. The ear symptoms in exanthematous diseases may be masked by the general symptoms. Children frequently have middle ear complication when suffering from some exanthemata.

Objective symptoms before rupture are intense redness of the drum which is followed in a short time by bulging of the drum, sometimes in its entirety but more often in the posterior superior quadrant. When the inflammation is confined to the attic of the tympanic cavity, the bulging may be confined to Shrapnell's membrane. The epithelial covering of the osseous portion of the auditory canal is frequently intensely hyperemic. The reduction of hearing varies according to the amount of serous exudate into the tympanic cavity and may be partially or completely negative. Crepitant rales are heard upon inflation and auscultation.

The membrana tympani in the otitis of influenza is covered with an exudate or by a hemorrhagic bullæ (Politzer). Hemorrhagic bullæ may cover the osseous portion of the auditory canal in otitis of influenza, as observed by the author.

The site of the perforation varies, being more often in the posterior and superior quadrant. It may be difficult to see the perforation when spontaneous rupture has taken place. Pulsation of the fluid at the point of rupture may disclose its location. The external auditory canal will be found to be filled with a tenacious muco-purulent secretion or pus, which continues to be profusely secreted for a week or ten days.

Course and Prognosis.—The course of the disease necessarily varies according to the character of the infection and the *tissue de resistance* of the patient. However, it is agreed that recovery is

very much slower in those cases in which the drum ruptures spontaneously than where paracentesis is performed.

The prognosis is not so favorable where the disease is concomitant with otorrhea chronica as it is in a simple acute inflammation.

The time of the rupture of the drum after the onset of the disease may vary from a few hours to a day.

Under favorable circumstances, the duration of the secretion is from one to three weeks. The closure of the drum follows very quickly the cessation of the inflammation and exudation, with partial or complete restoration of the hearing.

Mastoid complication, due to infection with the pneumococcus, may manifest itself after the otorrhea has passed away (Leutert).

The disease may terminate in any one of a number of ways, in complete recovery, progressive catarrhal inflammation of the middle ear, chronic purulent otitis media with necrosis of the ossicles, or mastoid abscess with or without cerebral complications.

Diagnosis.—It is frequently difficult to differentiate acute purulent inflammation of the middle ear from simple acute inflammation or myringitis, previous to rupture of the drum. There is no difficulty in making a correct diagnosis after the rupture has taken place. Bulging of the drum outward is suggestive of an accumulation of fluid in the middle ear. The character of the exudation behind the drum may be detected by the discoloration of the drum at the point of bulging.

Treatment.—The early treatment of the disease differs very little from that of simple, acute inflammation of the middle ear.

The general treatment consists of rest in bed, the administration of repeated doses of calomel until free purgation results and the control of pain by opiates if necessary. Leeches should be applied to the tragus and a blister behind the pinna.

The local treatment is directed both to the tympanic membrane and the relief of any inflammation in the post-nasal space of Eustachian tube. Four or five drops of a twelve and one-half per cent. solution of phenol in glycerin instilled into the auditory canal every half hour followed by applications of dry heat to the external ear may be ordered for the mitigation of pain in the ear before rupture

or paracentesis. Dry heat may be had from a hot-water bottle, Japanese hot-box, electric light bulb, hot plates wrapped in woolen cloths, etc., the application being as hot as the patient can bear. The nose and naso-pharynx may be sprayed every three or four hours with either Seiler's or Dobell's solution.

A twenty to thirty per cent. solution of argyrol may be applied to the ostium with a cotton-tipped probe. Three or four days after the inflammation has begun, the middle ears should be gently inflated by the Politzer method or Eustachian catheter, once daily. The inflation has a tendency to restore the patency of the middle ear and Eustachian tube so that drainage from the middle ear may take place.

When the pus or exudation has formed and forced the drum outward, paracentesis is at once indicated. The discharge following paracentesis may contain blood and serum, followed in a few hours by a profuse muco-purulent or purulent discharge. This condition continues for a week or ten days, ending in a complete cure in favorable cases. The auditory canal should be irrigated twice daily with a warm lysol solution, one-half drachm to a pint of warm water, at a temperature slightly above that of the body. Every effort should be made to prevent a mixed infection, and with this in mind, in addition to irrigating with a warm antiseptic solution, the folds of the auricle and the meatus should be cleansed with absolute alcohol, once daily.

The cotton or antiseptic gauze placed in the auditory canal should be changed whenever infiltrated with the secretion. In severe cases where the discharge is profuse, care should be taken to frequently cleanse the meatus, thus preventing any damming back of pus.

The drum may remain thickened and hyperemic for a few weeks after cessation of all inflammatory symptoms.

General tonics are frequently indicated with the correction of any catarrhal condition of the nose and naso-pharynx.

For the control of pain which sometimes continues after paracentesis, dry heat may be applied continuously and a ten per cent. solution of cocain, or twelve and one-half per cent. carbo-glycerin may be instilled in the auditory canal every two or three hours. A mild astringent may be used as an instillation twice daily after the

discharge has continued for a few days. The following is recommended for this:

℞ Zinc sulphate,		.60 gm. (gr. x)
Alcohol,		4.00 c.c. (ʒ i)
Sat. sol. acid boracica, Aq. destill.,	āā gr. ad.	30.00 c.c. (ʒ i)

Granulations which form on the drum at the site of the rupture or incision, should be touched with a twenty per cent. solution of nitrate of silver or a ten per cent. solution of trichloracetic acid followed by dusting with stearate of zinc. This should be repeated after two or three days if necessary.

After the perforation in the drum closes, local application to the ostium tuba of a thirty to fifty per cent. solution of argyrol and the occasional inflation of the tube and middle ear by air douche, Politzer method or with the Eustachian catheter is indicated, until the hearing is restored and the drum appears perfectly normal. After all discolorations of the drum have passed away and the hearing remains subnormal, inflation is contraindicated providing the tube remains patent.

As a prophylactic measure, the patient should be warned against exposure to irritations known to have produced the disease.

A guarded application of a fifty per cent. solution of trichloracetic acid should be made to the periphery of the perforation once weekly, where the perforation of the drum fails to close. A small amount of the solution reaching the middle ear will bring about a renewal of the discharge. Following the application of the trichloracetic acid, favorable results are frequently observed.

Chronic Otitis Media Purulenta—Chronic otitis media purulenta is a chronic purulent inflammation of the middle ear following acute perforating inflammation.

Etiology.—Among the predisposing causes of the continuance of a purulent discharge from the middle ear are syphilis, tubercular or strumous diathesis, malnutrition, naso-pharyngitis and adenoids.

The exciting cause of chronic purulent inflammation is smallness of the perforation and its unfavorable position for drainage, granulations within the tympanic cavity, necrosis of the ossicles, mixed

infection, retention of gauze or cotton in the canal and neglect of treatment.

Pathology and Morbid Anatomy.—The microörganisms most frequently found are the streptococcus pyogenes, staphylococcus pyogenes aureus and albus and saprophytes.

In the structure of the middle ear there is constantly going on a destruction of tissue, which may be circumscribed or diffused and may extend to the accessory cavities.

According to Politzer (p. 365), "There is usually a destruction of ciliated epithelium with a general thickening from infiltration of round cells, dilation of, and new formation of blood vessels.

"Covering the thickened mucous membrane are irregular fungiform excrescences which may fill the middle ear. Within the hypertrophied mucous membrane are situated cyst spaces," found also by Zeroni, "lined with cylindrical epithelium and filled with epithelial cells, leucocytes and detritus."

As a rule, there is more or less destruction of the membrana tympani. The size of the perforation varies and is often situated in the posterior half of the membrana tympani. The drum may become totally destroyed where the discharge has continued for a long time.

Of the ossicles, the malleus and incus are more frequently destroyed in suppuration of the middle ear, as reported by Schwartze, Grunert and others. According to Grunert, the incus is more often destroyed than the malleus. Suppuration and necrosis of the ossicles may continue until they are completely carious, when they are dissolved in the pus and washed away. Eburnation may occur at any time in the stage of necrosis or a rarefying otitis ending in destruction of the ossicles or formation of osteoplastic deposits, as observed by Katz.

Suppurative changes have a tendency to extend to contiguous parts and the epithelium of the auditory canal may invade the middle ear and mastoid process, producing cholesteatoma.

In addition to the local change, toxins are constantly eliminated which are taken up by the lymph and blood streams. Pus drains more or less into the naso-pharynx causing a systemic infection.

Symptomatology.—In the beginning of a chronic purulent discharge, the ear is usually free from pain. The discharge of pus from the ear is the one symptom of which the patient complains.

Headache may be complained of and is due to absorption of toxins, to bone involvement and meningeal irritation.

Deafness is variable, being slight or quite profound. If profound, there is usually some involvement of the labyrinth.

Tinnitus or dizziness very frequently accompany involvement of the labyrinth. Paralysis of the facial nerve may follow caries of the internal wall.

The tuning fork placed upon the vertex is heard best on the affected side. Rinne's test is totally or partially negative. Where there is involvement of the labyrinth, bone conduction will be partially or completely lost on the affected side. Upon examination of the external auditory canal, it is usually found filled with pus. In old syphilitic cases, the pus will frequently be scanty and form thick ill-smelling crusts in the deeper part of the auditory canal. The color of the pus varies, depending upon the microörganisms and composition of the exudation and may be white, yellow, greenish-yellow, blue (from the infection with the bacillus pyocyaneus), and reddish or brown from mixture with blood.

The secretion may be free from odor, mild or intensely fetid, depending upon the presence or absence of putrefactive bacteria.

The membrana tympani may appear hyperemic and thickened. A grayish ring will be frequently observed around the perforation. The perforation varies from the size of a pin-point to complete destruction of the drum and exposure of the tympanic cavity. Granulations may form about the perforation and in old cases calcareous deposits may be detected. Where the drum is destroyed, granulating tissue may be detected clustered about the entrance to the Eustachian tube or inner wall of the tympanic cavity. Scarlet polypi may frequently be observed extending through the perforation. Advisedly speaking, this condition is more often observed when the suppuration is through Shrapnell's membrane.

Perforation through Shrapnell's membrane is usually indicative of a chronic suppuration in the attic of the tympanic cavity.

According to Burnett, the perforation indicates disease of the naso-pharynx if located in the anterior part; suppuration in the mastoid cells, if located in the posterior part; bone disease of the external auditory canal, if located centrally. The presence of a perforation through the pars flaccida is detected by illumination rather than by auscultation, which is made impossible on account of adhesions, swelling, etc., which prevent air reaching the attic (Morpurgo, Politzer). The general appearance of the drum proper becomes altered with the suppuration within the attic and becomes hyperemic or dry and thickened.

The lymphatic glands of the ear and neck are frequently enlarged and tender to the touch. A dermatitis of the auricle often accompanies the disease, especially in strumous children.

Course and Prognosis.—The course of chronic otitis media is exceedingly variable: spontaneous recovery may take place with or without closure of the perforation in the drum. As long as the perforation in the drum remains, the patient is predisposed to a recurrence of the infection.

The presence of granulating tissue and polypi is suggestive of involvement of the osseous structure and will prolong the disease indefinitely, if allowed to remain.

A chronic purulent discharge is frequently from the mastoid antrum. Adhesive bands forming pockets between the membrana tympani and the middle ear structure for the retention of pus draining from the attic or mastoid antrum, should be destroyed by the removal of the drum and ossicles, otherwise a discharge may continue indefinitely.

According to Bezold, the duration of otorrhea depends upon the extent of involvement of the pneumatic cells of the mastoid process, and the continuance of a discharge after the acute stage has passed away, is due to this condition.

After cessation of a purulent otitis media, a new connective tissue band may be formed which, after a long time, becomes infiltrated with calcareous deposits and permanently alters the hearing.

The alteration in hearing is dependent upon the amount of destruction of tissue and adhesive processes formed within the middle

ear. Ankylosis between the malleus and the incus is equally destructive to the hearing.

The frequent presence of syphilis must not be overlooked as a factor in the prolongation of a chronic otitis media purulenta.

As long as pus remains in the tympanic cavity, it may be taken as an axiom that a virulent accentuation of the morbid process and extension to contiguous structures may occur at any time, and unless checked by surgical methods, ends in the death of the individual.

Diagnosis.—The diagnosis of a chronic purulent inflammation of the middle ear is comparatively simple under good illumination. As a rule, there is a history of discharge from the ear covering a period varying from a few months to a number of years.

Pus can be detected upon inspection, which is variable in both color and odor. As a rule there is no difficulty in detecting the presence of a perforation, since by inflation and auscultation a peculiar whistling sound is heard and the air passing through the auscultation tube is felt in the ear of the operator.

Treatment.—The treatment is both local and general. The general treatment is directed to the correction of any constitutional disease which might influence the local condition, such as syphilis, tuberculosis, diabetes, strumous or tubercular diathesis.

The presence of adenoids and enlarged tonsils should be sought for in young children and if present, removed. Incomplete drainage is an important factor in the prolongation of chronic purulent inflammation, and with this in mind, our attention is directed to the enlargement of small perforations in the drum, especially in those situated in the superior portion. Small perforations in Shrapnell's membrane may be enlarged anteriorly or posteriorly. In suppuration in the attic of the ear, Prussak's pouch may be filled with pus, which can only be emptied by irrigation. A perforation large enough to freely admit the point of a middle ear syringe is necessary to irrigate the attic successfully. In irrigating the middle ear, especially through the Eustachian tube, a small perforation may so retard the flow of the fluid mixed with the pus as to cause a portion to be washed into the antrum and anterior attic of the middle ear and predispose to infection in those parts. In those old enough to submit to the

procedure, irrigation of the middle ear is best accomplished through the Eustachian tube. The structures are cleansed, as far as possible, of any secretion by this method.

The patient may depend upon the irrigation of the tympanic cavity through the external canal for cleansing at home. The great majority of syringes used by the laity are totally useless and the patient should be instructed to use a fountain syringe. The reservoir of the syringe should be elevated from one to two feet above the head and the nozzle inserted into the ear. The current can be regulated by the elevation or lowering of the reservoir. Too much force should be avoided on account of the tendency to produce dizziness and syncope.

Before the ear is irrigated, the pus in the Eustachian tube and middle ear should be forced out by gentle Politzerization or by inflation through the Eustachian catheter. The pneumatic otoscope is also recommended for the withdrawal of pus from the middle ear. One of the following solutions slightly above the temperature of the body may be used for irrigating.

℞ Lysol, 2.00 c.c. (ʒ ss)
Aq. destill., 480.00 c.c. (Oi)

℞ Sol. hydrarg. bichlorid, 1/5,000

℞ One per cent. sol. carbolic acid.

℞ Normal salt solution.

To facilitate the drying of the membrana tympani or tympanic cavity after irrigation, a twenty-five per cent. solution of alcohol should be dropped into the ear. The canal and middle ear are afterward dried with a pledget of cotton on a probe or ordinary wooden toothpick. If the tympanic mucosa is visible and there is a red granular appearance, a two to four per cent. solution of nitrate of silver may be applied with a cotton-tipped probe to the mouth of the Eustachian tube and the mucous membrane.

The patient may be ordered the following for home treatment:

℞ Hydrogen peroxid,
Signa. Four or five drops to be instilled into the ear morning and night.

After the boiling sensation in the ear, following the application of the peroxid of hydrogen, has passed away, the patient should dry the auditory canal and drop three or four drops of the following into the ear:

℞	Zinci Sulphatis,	.24 gm. (gr. iv)
	Alcoholis,	8.00 c.c. (ʒ ii)
	Glycerini,	4.00 c.c. (ʒ i)
	Aq. destill., q. s. ad.	30.00 c.c. (ʒ i)

The solution of the bichlorid of mercury is contraindicated in children on account of the danger of the fluid passing into the throat and thus causing intestinal irritation. In both children and adults, solutions of bichlorid of mercury have no effect as a germicide in the strength well borne and in stronger solutions are very irritating to the mucous membrane.

The fetid secretion is combated by dropping into the ear a solution of menthol and distilled water equal parts, three or four times daily, and closing the ear with shinlon-naphthol gauze.

Hotz speaks very highly of camphoroxol and menthoxol, where other remedies have failed to give relief in the treatment of chronic otorrhea. This may be diluted one-half with sterilized water and injected into the middle ear by means of the intratympanic catheter. The ear should be treated once a day with camphoroxol in full strength, and for home use, a solution of equal parts of camphoroxol and water should be used in the ear twice daily. When the site of the perforation is in the attic and the perforation is in the membrana flaccida, irrigation of the attic by means of the Blake middle ear syringe is often very beneficial. Camphoroxol diluted one-half may be syringed into the attic once daily. When the discharge has continued for some time, necrosis of the ossicles with the formation of granulating tissue or polypi may demand surgical measures. For the removal of polypi, an application of a fifty per cent. solution of chromic acid or curettement is demanded. Granulations may gradually disappear under the application of camphoroxol in full strength. Necrotic areas in the bony structure of the middle ear may disappear under thorough cleansing. There is a proliferation of new bone cells and repair takes place as in suppuration in any other bony portion. In

many cases repair will not take place until after ossiculectomy or the radical mastoid operation with the complete removal of all necrotic tissue within the middle ear and antrum. A catarrhal condition of the nose and throat should have frequent attention. A warm antiseptic gargle once or twice daily aids in keeping the Eustachian tube patent, which is necessary for rarefaction of air in the middle ear.

It may occur that aqueous solutions are not well borne in the ear. With this in mind, the dry form of treatment may be substituted. This consists of cleansing the ear as above recommended, drying and dusting the middle ear with aristol, iodoform, stearate of zinc or boracic acid.

The possibility of an osseous erosin in the tegmen tympani and the sigmoid groove, should be remembered, and the forcible injection of fluids into the middle ear may, in consequence, drive the solutions directly into the cerebral cavity, producing meningitis and death.

In many cases the perforation, if not too great, may close a few weeks after suppuration has ceased. If possible, the orifice in the membrana tympani should be closed to prevent reinfection from the external auditory canal. The most satisfactory and expeditious method of closing a perforation is by the careful application to the periphery of the perforation of a fifty per cent. solution of trichloracetic acid, as recommended by Okuners. By the stimulation and escharotic effect of the acid, the infolding epithelium may be destroyed and new granulations form.

Tuberculosis of the Middle Ear.—(See Tuberculosis of the Ear in General Diseases.)

Etiology.—Tubercular inflammation of the middle ear is so named because of the presence of the tubercle bacilli. The tubercle bacilli may reach the middle ear through the blood stream or the lumen of the Eustachian tube and are forced into the middle ear in douching or in blowing the nose. The metabolism of the tube and middle ear may be disturbed by cold, post-nasal catarrh, adenoids and diseased tonsils.

The disease may originate *de novo* or be secondary to an existing lesion elsewhere.

The tubercle bacillus is found as the exciting cause of suppuration

or secondary to an acute simple otitis media or an acute otitis media purulenta. The tubercle bacilli have been known to be present in a non-suppurative otitis media, as reported by Wingrave.

A tubercle dyscrasia or lowered vitality from infection in some portion of the body, predisposes the middle ear to infection from any of the pathogenic organisms which may find entrance to the middle ear.

The toxins of the bacilli circulate in the blood and may also play a very important part in the causation of suppuration in the middle ear.

Primary tuberculosis is frequently seen in children. On account of the greater patency and shortness of the Eustachian tube in infants, secondary tuberculosis of the middle ear is frequently observed and is produced by the tubercle bacilli being forced into the tube and middle ear by the acts of coughing and blowing the nose. The deafness is not infrequently a secondary affection and is a result of tuberculosis of the lungs.

Diagnosis.—The detection of tubercle bacilli in an acute or chronic otitis media purulenta, accompanying or secondary to a tuberculosis of the respiratory region, is hardly necessary for the differential diagnosis of tuberculosis of the middle ear. For the diagnosis of primary tuberculosis of the middle ear, the detection of tubercle bacilli is necessary for the differentiation of the disease.

According to Levy, the ear complication may manifest itself at the very conception of the general disease. A tentative diagnosis of tuberculosis may be given to a suppurative ear accompanying a general tuberculosis.

Symptomatology.—The ear symptoms frequently appear after the lung complications are established. There may be tinnitus followed by deafness and painless rupture of the drum and a thin mucous or muco-purulent discharge. On the other hand, the symptoms may vary in no wise from simple acute otitis media.

Prognosis.—The prognosis is usually unfavorable. Necrosis and destruction of tissue progress very rapidly. Local and surgical measures may stay the disease, though the discharge is seldom relieved in cases with severe general tuberculosis. In the mild form of the disease, both local and general, the ear symptoms may be cured.

Treatment.—The surgical treatment is the same as for acute or chronic otitis media. Out-door exercise and nutritive diet are especially essential.

Otitis Media in General Diseases.—The frequency of middle ear complication in general diseases has been mentioned in a consideration of the etiology and pathology of acute and purulent inflammation of the middle ear.

Diphtheria, measles, influenza, scarlet fever, typhoid fever, tuberculosis, pneumonia, diabetes, syphilis, pernicious anemia and leukemia are diseases in which middle ear inflammation may occur.

The pathogenesis of the ear infection differs somewhat in each case.

Diphtheria.—Diphtheria is due to an extension of infection through the Eustachian tube, external auditory canal and blood stream. The disease is more often observed in children on account of the dilated tube. The symptoms of a concomitant otitis are those of a simple acute otitis media.

Lomel, in the report of twenty-five post-mortems, came to the conclusion that middle ear infection was a part of the general infection and was not due to an extension of the disease through the Eustachian tube.

Diagnosis.—The diagnosis is made by the pain in the ear and inspection of the drum.

Treatment.—The treatment is the same as for acute otitis media and general diphtheritic infection.

Measles.—As shown by the investigations of Bezold, the middle ear is always affected in patients suffering from measles. In consequence, the ear should be inspected daily for symptoms of inflammation and the necessary steps taken to forestall inflammation by attention to the post-nasal space and ostium tuba and instillation into the external auditory canal of a twelve and one-half per cent. solution of carbolic acid in glycerin. Bulging of the drum must be treated by free paracentesis.

Scarlet Fever.—The frequency of involvement of the middle ear in scarlet fever is very great. According to Burkner, quoted by Bruhl-Politzer, twelve per cent. of all chronic middle ear suppuration and many cases of deaf-mutism are directly due to scarlet fever.

There is usually a definite osteitis of the bony structure of the Eustachian tube and middle ear in scarlatinal otitis. At the end of the desquamative period and while the child is about, the symptoms of acute otitis media may become manifest.

Spontaneous perforation of the drum may occur with or without great pain in the ear. The ear involvement occurring during the eruptive period of the disease is usually more virulent and frequently ends in a chronic purulent inflammation with necrosis of the ossicles and later a mastoid involvement. The symptoms and treatment are the same as in acute otitis media purulenta.

The throat and nose should be frequently sprayed with Dobell's solution and a hot gargle of Dobell's solution should be ordered to relieve the congestion of the Eustachian tube.

Influenza.—Aural complications in epidemics of la grippe are so insidious and far-reaching that the first symptoms of ear involvement must not be underestimated. The mastoid and cerebral involvements may manifest themselves after all the acute symptoms have passed away.

The symptoms of middle ear involvement vary and may be a mild infection ending in a few days in spontaneous recovery or in rapid infiltration of the mucosa, exudation and all symptoms of a severe purulent otitis media and mastoiditis. (See Acute Otitis Media Purulenta, page 231).

Treatment.—Where there is great pain, the treatment consists in the instillation of a twelve and one-half per cent. carboglycerin solution and dry heat to the ear. There should be no delay in making an incision in the drum from the superior and posterior quadrant down to the floor of the canal, thus establishing free drainage. If the inflammatory reaction in the ear is pronounced, it is unnecessary to wait until bulging of the drum has occurred before incision is made. Intercranial complications frequently occur from extension through the tegmen tympani or mastoid process.

Typhoid Fever.—The aural symptoms are dependent upon the severity of the primary disease. The inflammation is due to the toxins of the disease circulating in the blood or to the invasion of the bacterium coli into the middle ear. The resistance of the tissue

becomes so reduced during typhoid fever that a mixed infection within the tympanic cavity from the accumulation of bacteria in the naso-pharynx is always a possibility. Day and Jackson (*The Laryngoscope*, December, 1904) describe three distinct types of purulent acute otitis media in typhoid fever: the hemorrhagic, the slow and the fulminating.

The disease is sudden in its onset and except in the slow form, is characterized by intense pain in the ear. The pain may continue four or five days, ending in slow recovery or rupture of the drum. Day and Jackson report that in ten cases observed no inflammatory symptoms were present twenty-four to forty-eight hours previous to spontaneous rupture of the drum.

Symptomatology.—The symptoms are of a mild or severe inflammation of the middle ear with frequently a slight tenderness over the mastoid. "Hemorrhagic blebs may form on the drum and auditory canal, followed later by a purulent middle ear inflammation" (Day and Jackson). The ear complications begin about the third or fourth week of the disease and are more frequent in children.

Treatment.—The treatment is directed to frequent cleansing of the nose and throat with a mild alkaline spray. As soon as the drum is distended by accumulation of mucus and blood, free drainage should be established by paracentesis. Spontaneous rupture is to be forestalled by incision of the drum, on account of the tendency of the inflammation to lapse into a chronic purulent otitis media after spontaneous rupture.

The ear should be irrigated with a normal salt solution or a saturated boracic acid solution a few hours after paracentesis. This should be repeated twice daily. A tampon of bichlorid gauze should be pushed deep into the canal and as soon as it becomes moist with the secretion, it should be removed and a new one introduced.

Tuberculosis.—On account of the width of the tube in children, tuberculosis of the middle ear is easily brought about by infection of tubercle bacilli being forced into the middle ear in the act of coughing and blowing the nose. In adults as well as in children, the avenue of infection is through the Eustachian tube or blood stream, and may be a primary or secondary infection.

It is known that a predisposition to tuberculosis may exist and in consequence of this lowering of the tissue resistance of the middle ear, the tubercle bacilli may find lodgment and bring about a local inflammation. The process of the disease is variable and may be non-inflammatory or inflammatory. The former is characterized by the formation of deposits on the mucous membrane, containing the tubercle bacilli. Ulcerations may occur after a long period, with external changes in the drum and canal.

In the inflammatory form, active ulceration and rapid necrosis of the tissue frequently extend to the temporal bone and mastoid with a formation of fetid and caseous pus. Mixed infection in the ear is more often the rule for the reason that the majority of cases occur in children and adults who frequent charity clinics and are proverbially tardy in seeking relief.

Adenoids and hypertrophied tonsils, on account of the frequency of primary infection, predispose to the disease. Among the more complicated symptoms are loss of hearing, tinnitus, absence of pain, discharge of pus from the ear, necrosis of the ossicles, cachexia, swelling and sometimes suppuration of the glands of the neck, frequently paralysis of the facial nerve from necrosis of the inner osseous wall, one or more perforations in the drum, and nasal catarrh.

Treatment.—The general treatment is directed to building up the system by tonics and abundance of fresh air.

The local treatment is the same as for chronic otitis media purulenta. The contagiousness of the disease should be uppermost in the mind of the physician. Cotton or antiseptic gauze should be worn constantly in the ear and when moistened with the secretion, should be removed and burned.

Pneumonia.—The pneumococcus or some other infection producing the disease may be forced through the Eustachian tube during the act of coughing or blowing the nose. Otitis media often accompanies bronchial pneumonia and occurs during the stage of resolution.

Treatment.—The treatment is the same as recommended for acute otitis media.

Diabetes.—The presence of glycosuria may so disturb the nutrition of the mucous membrane and bony structures of the ear as to

predispose to hemorrhagic extravasations of the drum, middle or internal ear inflammation and fulminating perforative otitis media.

Grunert reports the appearance of glycosuria secondary to otitis with brain complications. With the operative treatment of the middle ear and brain involvement, the glycosuria entirely passed away. The question of the advisability of operative procedure on the ear in well-developed cases of Bright's disease is questionable. Operative procedure is dangerous on account of the possibility of fatal coma.

Syphilis.—Cutaneous eruptions of syphilitic origin may occur on the membrana tympani, as reported by Gruber. Acute catarrhal inflammation and acute suppurative inflammation of the tympanic cavity may occur from ulceration in the tonsils, pharynx and orifice of the Eustachian tube. The tubal epithelium becomes diseased, thus permitting the entrance of pathogenic organisms from the throat. In the early lesions of syphilis, the mucous membrane of the naso-pharynx will be seen red and edematous and secreting a muco-purulent substance. The inflammatory condition may spread to the lining of the Eustachian tube from continuity of tissue, or the toxins from the disease and the toxins produced by continued suppurative inflammation in the throat may irritate the mucous lining of the ear, predisposing to infection from any organism which may find lodgment. A chronic suppuration of the middle ear accompanying secondary and tertiary lesions, is not infrequent. The destruction of tissue in the ear accompanying syphilis is greater than in an ordinary infection. The course of syphilitic inflammation of the middle ear is variable. Adhesive catarrh and suppuration with involvement of the labyrinth are often observed.

Treatment.—In addition to the treatment recommended for hypertrophic catarrh of the middle ear and acute or chronic suppuration, mercury, iodid of potassium and nutritive diet are indicated and alcoholic liquors contraindicated.

Pernicious Anemia.—Ear complications in pernicious anemia are infrequent or heretofore unobserved. Schwabach reports one case with pathological findings. The treatment is purely subjective.

Leukemia.—Purpura of the mucous membrane of the middle ear, as in other mucous membranes of the body, may occur. Ear complic-

ations require but little treatment other than patience, as most cases die in one to three years.

Actinomycosis.—According to Bruhl and Politzer, the disease is rarely primary in the middle ear and is more often secondary to infection in the jaw. (See Pathology of Actinomycosis.)

Acute Eustachian Tubal Catarrh or Acute Salpingitis.—Acute tubal catarrh is an acute inflammation of the mucous membrane of the cartilaginous portion of the Eustachian tube.

Etiology.—The cause of the disease is acute coryza, acute nasopharyngitis, infection from some pathogenic microörganism, trauma of the tube, irritation from the post-nasal douche or spray, adenoid vegetations, hypertrophied tonsils or the entrance of water into the tube while bathing.

Symptomatology.—The tube becomes swollen, hyperemic and covered with exudation of serum, mucus and broken-down epithelial cells. The congestion of the ostium tuba may be observed upon post-rhinoscopic examination. Upon inflation by the Politzer method or catheter, mucous rales are detected and the hearing, which is very much reduced, is temporarily increased. The patient endeavors to open the tube by swallowing and pulling the lobe of the ear.

Course and Prognosis.—The disease usually runs its course in a fortnight, the progress being favorable in simple, uncomplicated salpingitis. There is a great tendency of the disease to merge into a chronic salpingitis, where post-nasal catarrh and obstruction in the upper respiratory passsages are present.

Diagnosis.—The disease is differentiated from acute catarrhal inflammation of the Eustachian tube and middle ear and from acute otitis media by the normal coloring of the drum, retracted light spots, fullness in the ears and continuous itching and irritation in the region of the drum and around the orifice of the Eustachian tube.

Treatment.—The treatment consists in the careful cleansing of the post-nasal space with Dobell's solution and the application of argentum nitrate, ten grains to the ounce, to the tubal mouth by means of a cotton-tipped probe. In blowing the nose following the use of the douche or spray, the patient should be instructed to make pressure upon one side of the nose only; by doing this, free exit of air is per-

mitted and the probability of forcing air or liquids into the tube or middle ear is reduced to a minimum. As a rule, the patency of the tube can be restored by gentle inflation with the Politzer bag and catheter. The Politzer bag alone is used in children. After the tube is opened, it may be treated by means of the Bishop improved inflator or as recommended by Dench, if the condition has failed to improve after ten days, stimulating applications in the form of vapors are indicated. This is done by means of a middle ear vaporizer or Seeley's hot-air applicator with Pynchon's inflator attached.

The administration of ten grains of Dover's powders in the beginning of the disease with a hot foot bath previous to retiring will lessen the severity. The passage of bougies is seldom indicated for opening the canal.

Chronic Eustachian Tubal Catarrh or Chronic Salpingitis.—This is a chronic inflammation of the entire structure of the mucous membrane lining the Eustachian tube.

Etiology and Pathology.—The neglected acute salpingitis may become chronic, bringing about a hypertrophy of the mucous membrane with stenosis of the tube. Chronic inflammatory changes of the nasal mucosa predispose to a chronic salpingitis of the mucous membrane. Sclerosis may subsequently occur.

Course and Symptomatology.—Chronic catarrhal inflammation gradually extends to the middle ear, bringing about a condition of hyperplasia of the mucous membrane, and resembles sclerosis of the middle ear.

Treatment.—Stricture of the tube should be destroyed by inflation, electrolysis or hard-rubber filiform bougie. The bougie should not be passed oftener than once weekly. Where the ostium tuba is swollen or covered with a mucous exudation, a fifty per cent. solution of argyrol should be applied to the mouth of the tube with a cotton-tipped probe, or two or three drops injected into the catheter with a syringe and forced into the Eustachian tube with a Politzer bag. Where mucus continues to occlude the tube, the fumes of sal-ammoniac may be injected twice weekly. An oil solution of camphor, menthol and iodin may be injected into the Eustachian tube through the catheter twice weekly for five or six weeks. The Eustachian tube

should be inflated once weekly during this period, until recovery is complete or the progress of the disease is brought to a standstill. External massage to the neck is recommended. Any abnormal condition in the nose and throat should be corrected.

Ulceration of the Pharyngeal Orifice of the Tube.—Ulceration of the orifice of the tube may be due to infection, syphilis, tuberculosis, diphtheria and carcinoma.

The course of the disease is variable and depends particularly upon the early detection of the ulceration and the cause of the disease. Marked destruction of the orifice may occur if the ulceration is very great, bringing about adhesions, scars and atresia.

Treatment.—The treatment is both local and general.

The general treatment is directed to the correction of any constitutional dyscrasia. Simple ulcer of the tubal orifice should be touched twice weekly with a fifty per cent. solution of trichloracetic acid, followed by a spray of a two per cent. solution of camphor and menthol in albolene. The patient should be instructed to spray the nose and naso-pharynx twice daily with a warm Dobell's solution.

Acute Mastoiditis.—Acute mastoiditis may be a primary or secondary inflammation. Inflammation of the mastoid as a primary disease is one seldom observed and is due to infection finding its way to the periosteum or the pneumatic spaces from the naso-pharynx or through the blood and lymph channels. The exciting causes are syphilis, influenza, trauma and micrococci.

As a secondary disease, it is the sequela of acute or chronic serous or acute or chronic purulent otitis media. Among the predisposing causes are inflammation of the middle ear, exanthematous diseases, la grippe, tuberculosis, syphilis and pathogenic infection.

From continuity of tissue, "the mastoid cells are more or less involved in every case in inflammation of the middle ear;" abscess of the mastoid cells as a secondary infection is fortunately the exception. Excessive discharge of pus from the middle ear may so fill the external auditory canal, that, from the want of free exit, it is forced back into the *aditus ad antrum* with sufficient force to destroy the mucous membrane by pressure; infection follows with necrosis of the contiguous bone.

According to Politzer, abscess of the mastoid may exist for months without subjective or objective signs.

Symptomatology.—The symptoms of acute primary periostitis of the mastoid are heat, redness and swelling of the skin behind the auricle. There is pain and tenderness upon pressure. The disease terminates in three or four days in recovery or involvement of the deeper structures with the formation of an abscess. The symptoms of acute inflammation of the mastoid cells are the same as in the secondary variety with the exception that there is no middle ear involvement.

The symptoms in the secondary form vary in individuals, manifesting themselves before or after paracentesis or spontaneous rupture of the drum. Tenderness, persistent or remittent pain, redness and swelling over the mastoid and bulging of the superior and posterior auditory canal are the most prominent symptoms. The temperature varies from the normal to 104° F. and is much higher in infants. If the case is observed before rupture, the drum will be seen bulging in the posterior and superior portions. The discharge from the ear is usually profuse after the rupture of the drum. Facial paralysis not infrequently occurs in children, and infection may spread along the nerve sheath to the base of the brain, or through the wall of the Eustachian tube, producing a retro-pharyngeal abscess.

In simple inflammation of the mastoid, especially in children, the pain complained of is often very slight, due to the softness of the bony structures. This is especially true in those cases amenable to abortive treatment. In cases of more virulency, the pain over the mastoid increases hourly and is not relieved until the cells are opened and drained. A sudden cessation of the discharge from the ear with tenderness over the mastoid is suggestive of serious mastoid complication. The presence of streptococcic infection is indicative of rapid necrosis and is an indication for an early operative procedure.

Course and Prognosis.—The disease may terminate in recovery in a week or ten days or in the formation of pus and destruction of bone, and not infrequently meningitis, brain abscess, facial paralysis, sinus phlebitis and thrombosis. In young children especially, on account of the uncertain cementing of the different structures of the

temporal bone, imperfect ossification, and the possibility of extension of infection along the veins and nerve sheaths, suppurative leptomeningitis of the cerebellum and basal ganglia is liable to occur.

The prognosis in simple, uncomplicated mastoid inflammation is favorable, but when complicated with influenza, tuberculosis, diphtheria, scarlet fever, cerebral complications, etc., the prognosis is uncertain.

Treatment.—The treatment of acute abscess of the mastoid process is divided into medical and surgical.

By medical is meant the use of minor surgical methods and the application of antiphlogistic remedies which aid in the absorption of morbid products thrown out into the pneumatic spaces. When the case is seen early, an effort should be made to abort acute inflammation of the mastoid. Cold application, by means of the Leiter coil or cracked ice in rubber bags, is especially indicated. This should be continued for twenty-four hours without interruption. The patient should be absolutely confined to bed, given light diet and gentle purgative. If the pain and inflammation continue after forty-eight hours, mastoidectomy is indicated. For the elevation of temperature, acetanilid in five-grain doses should be repeated hourly until fifteen grains have been taken (Dench). The drum should be incised if the drainage is not complete, the incision extending from Shrapnell's membrane to the floor of the middle ear. Constant attention should be directed to freeing the middle ear of any purulent discharge, by irrigating with a warm lysol solution, one-half drachm to a pint of warm water. The pneumatic otoscope may enable us to remove a great amount of pus from the middle ear.

Two surgical procedures are at our disposal when there is abscess formation with necrosis; the simple and the radical mastoid operation. (See Technique of Radical Mastoid Operation.) The great majority of cases of suppurative mastoiditis require only the simple mastoid operation, that is, the opening of the abscess cavity and exposure of the antrum. The results of this operation are more satisfactory, the wound heals more quickly, leaving a small scar.

The anatomical structure of the temporal bone and variations in infancy from that in the adult must necessarily govern the surgical

procedure. In infancy the antrum lies much nearer the surface of the temporal bone and occasionally is simply one large cavity filling the mastoid process. The inner or bony auditory canal may only be a very thin plate of bone and easily perforated in resection or in the process of curetting the antrum. The external plate covering the antrum is formed by a downward extension of the squamous bone which joins the mastoid process at the masto-squamosal suture. Below the lower edge of the zygoma, anterior and above the masto-squamosal suture and posterior to the osseous wall of the auditory canal, lies the supra-meatal triangle beneath which is situated the mastoid antrum (see page 22), landmarks to operative procedure. The position of the sigmoid groove varies likewise in infants and adults. In infants and before the development of the mastoid cells, the groove is much nearer the surface of the squamous bone and in consequence of the thinness of the bone separating the wall of the groove from the antrum, perforation with a gouge or curette is always possible. The knee of the sinus which is the part most anterior is most liable to injury. The surgical treatment of a mastoid abscess in infants varies in consequence from that of an individual after puberty. The operation in infants differs from that about to be described in this respect, that a simple post-auricular incision down to the periosteum and exposure of the antrum at the infra-meatal triangle, perforation of the external wall and exposure of the antrum with the establishment of free drainage is usually all that is necessary. The wound is treated as after simple mastoidectomy.

The instruments necessary for the simple mastoid operation (Schwartze mastoid operation) are a scalpel, artery forceps, periosteum elevator, scissors, two large retractors or speculum, three small gouges, 3, 5, 6 mm. wide, small curette, small blunt probe, bone forceps, metal hammer filled with lead, Macewen's small curette and seeker, Stäcke's guide, ligature, curved needle, antiseptic gauze and bandage.

The operation is performed under chloroform or ether narcosis with the most rigid antiseptic precautions. The side of the head should be shaved a few hours preceding the operation, washed with soap and hot water, followed by washing with pure alcohol. The

external auditory canal should be irrigated with bichlorid solution 1/5,000 and tamponed with iodoform gauze. A tampon dipped in bichlorid 1/1,000 should then be placed over the site of the operation. With the exception of the knives, the instruments should be boiled for one-half hour in a one per cent. solution of carbolic acid and soda. The knives may be cleansed by dipping in pure alcohol and in formalin solution.

In the simple mastoid operation, an incision is made beginning at the middle of the tip of the mastoid process, extending upward and backward in a curved line one-half to three-quarters of an inch behind the auricle to the superior auricular attachment and then forward to the anterior attachment of the helix. On account of the severity of the hemorrhage, we should avoid as far as possible cutting the facia of the temporal muscle. The first incision should be down to and through the periosteum. The edges of the wound are then separated with a retractor and the bleeding vessel ligated or compressed. The periosteum is then separated; the site of election for opening into the cells and also the antrum is above and behind the external auditory meatus, five millimeters behind the spine of Henle and anterior to the mastoido-squamosal suture. A portion of the cortex one cm. wide and one and one-half cm. long is chiseled away with a small chisel. The thickness of the cortex varies in individuals as does also the amount of pneumatic structure; in children especially the pneumatic structure may be opened at the first incision of the knife. The abscess is soon reached, as shown by the presence of pus. The bony cavity is enlarged in the direction of the abscess cavity. The necrotic tissue with granulations is scraped away with a spoon and the wound tamponed with iodoform gauze. The question of opening the antrum at this time is decided by the condition of the wall separating the abscess cavity, which condition is easily demonstrated by the small Macewen curette and seeker. Should soft, necrotic bone be observed, a direct opening is usually made into the antrum with a sharp curette without resorting to the gouge. The antrum and middle ear are then thoroughly disinfected by irrigation and tamponed with iodoform gauze. As recommended by Whiting, a layer of semitransparent fenestrated rubber tissue may be so placed

beneath the gauze as to line the mastoid cavity and prevent the gauze from adhering to the wound. Strips of iodoform gauze are placed in the external auditory canal and bandage applied. Where the wound is lined with rubber tissue, as recommended by Whiting, the packing and rubber tissue should be removed in twenty-four hours. The wound should now be gently repacked with strips of gauze, which are allowed to remain for four or five days, when the gauze is removed and the wound dressed daily until recovery.

If the wound is dressed at the time of the operation with strips of gauze alone, the external dressing may be changed in twenty-four hours. If the wound is found to be free from secretion and the patient complains of no pain or disturbance, the dressing is left in place for four or five days, when it should be removed and a new tampon and gauze dressing applied. The patient may be allowed to sit up after twenty-four hours and may go about the ward after fifty-two hours. The time of recovery varies from three to ten weeks. Complications may arise such as continued high fever with dizziness, vomiting and radiating pain over the temple, which are suggestive symptoms of meningitis, pachymeningitis or sinus phlebitis. Under such circumstances, the wound is reopened and the radical operation performed with the exposure of the sinus or dura mater. (See Post-operative Treatment, p. 163.)

Chronic Mastoiditis.—Chronic mastoiditis is a chronic purulent inflammation within the antrum and the mastoid cells, the sequelæ of acute purulent inflammation of the middle ear. The slow form of suppuration with necrosis of the epithelial cells lining the mastoid cells and subsequent change in the osseous structure is brought about by the imperfect drainage. New bone tissues may be formed as a result of the suppuration, which partially fills the antrum, bringing about a condition known as osteosclerosis. From necrotic change in the walls, rupture may occur on the external surface or in the cranial cavity. Pus from the antrum is usually thick and fetid.

Course.—The course of the disease is variable. Many patients go through life with a chronic slow form of necrosis in the mastoid without serious inconvenience other than the discharge from the middle ear. In others, a sudden onset of pain, redness and swelling of the

mastoid with elevation of the temperature, bulging of the upper and posterior walls, headache and nausea will suggest grave complications and an immediate operation for the evacuation of pus, granulated tissue and necrotic bone in the antrum and middle ear. Dizziness, anorexia, sluggish pupils, thready pulse with slight elevation of temperature are suggestive symptoms of intercranial pressure demanding the radical mastoid operation.

Diagnosis.—The retention of pus in the antrum from imperfect drainage during sleep may produce headache, pain over the frontal region and temple of the affected side, dizziness and nausea upon awakening. (See Slumbering Mastoiditis.) By transillumination with a high candle power diagnostic lamp covered with a rubber hood designed by Andrews, a diseased condition of the mastoid will be detected by the imperfect illumination of the auditory canal, viewed through an ordinary ear speculum.

Treatment.—In chronic, purulent mastoiditis without active inflammatory conditions, when all forms of therapy have been unsuccessfully tried, two methods of operative procedure are at our disposal; ossiculectomy and the radical mastoid operation. When active inflammatory changes have taken place in the antrum and cells or there is involvement of the cranial wall, the radical mastoid operation is the only alternative.

The operation of ossiculectomy consists in the complete removal of the ossicles and drum membrane through the auditory canal (see Ossiculectomy. Many cases of chronic, purulent inflammation of the middle ear and antrum are cured by this comparatively simple operation. The results of this operation are sometimes very slow and there is a liability of recurrence. The fact that the diseased attic is obscured from observation prevents thoroughness of curettement of the necrotic bone. In recommending this operation, which cannot be considered good surgery, uncertainty of a cure must not be overlooked.

Osteosclerosis of the Mastoid.—Osteosclerosis is the formation of new bone within the antrum and mastoid cells. It may be localized or general. A localized area of new bone is called enostosis. The formation of new bone is often a part of an acute periostitis,

in which there are deposits of new layers of spongy bone. The accumulation of spongy bone brings about an eburnation or osteosclerosis. In addition to inflammation as a cause, we may have senile change, tuberculosis, syphilis and localized ulcerations.

Symptomatology.—There is a loss of bone conduction, neuralgia of the mastoid and temporal region and sometimes a fetid discharge

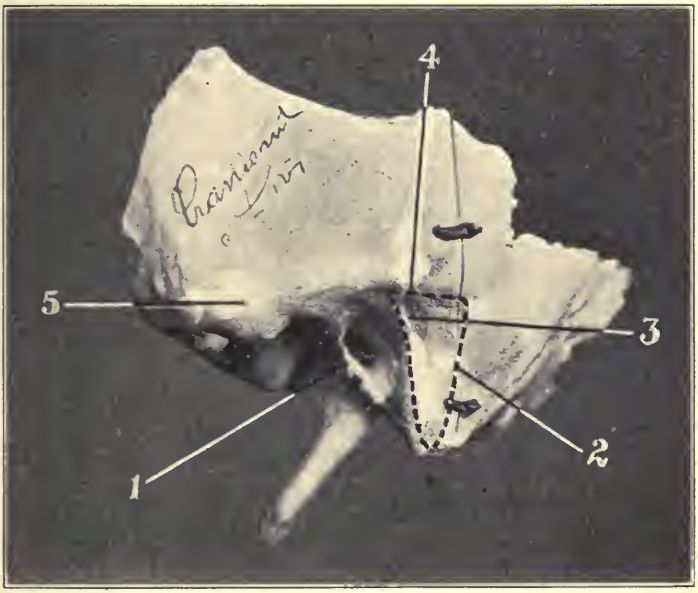

FIG. 89.—THE AREA APPROXIMATE OF OPERATION IN SIMPLE MASTOIDECTOMY.

1. Anterior wall of the bony meatus; 2, approximate area of operation for removal of accessory cells of the mastoid process; 3, spine of Henle; 4, supramastoid ridge; 5, the zygoma.

from the attic of the tympanic cavity. There is usually a history of a discharge from the middle ear which may have continued for only a short time or for an indefinite period. Where there has been no discharge from the middle ear for a long period, objective symptoms may be entirely absent. Acute or chronic abscess of the temporal lobe may be a sequela of the disease, due to extension of infec-

tion through the roof of the antrum or middle ear (see Symptoms of Abscess of Temporal Lobe).

Treatment.—The complete removal of the spongy from the compact bone should be made according to the lines laid down for the radical mastoid operation, with the exception that it is unnecessary to remove the anterior osseous walls of the antrum or enter the middle ear. The post-auricular wound should be allowed to heal by a process of granulation.

Radical Mastoid Operation.—The indications for the radical removal of all cell spaces of the mastoid and the bones of the middle ear should be well marked before resorting to this procedure. Cases of chronic, purulent inflammation of the mastoid cells may recover by a process of osteosclerosis. It is well to remember the great danger which may momentarily result from the presence of pathogenic infection so near the brain and fully acquaint patients with this condition.

Among the alarming symptoms indicating the radical mastoid operation in chronic otitis media purulenta, are headache, pyrexia, pain radiating to the supra-orbital region of the affected side, temple

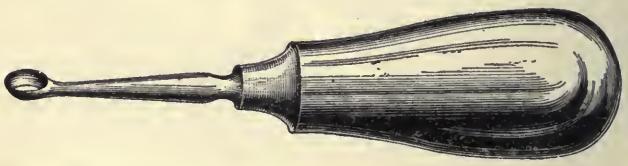

Fig. 90.—McKernon's Curette.

and neck, optic neuritis, cholesteatoma, excessive polypoid formations, paralysis of the facial nerve, dizziness, fistula of the mastoid, offensive discharge from the middle ear with general septic infection and Bezold's disease, *i. e.*, rupture of the mastoid abscess in the inner side of the apex into the digastric fossa and beneath the sternomastoid muscle.

The existence or non-existence of a perforation in the drum head should have no significance where there was a history of purulent discharge from the ear and there remains pain in the mastoid, ten-

derness upon pressure, and headache, which have no tendency to rapid disappearance.

The true radical mastoid operation consists in the laying bare of the entire accessory cavities of the ear. Gruening has modified the Schwartze operation somewhat and recommends the removal of the pneumatic spaces and cells at the superior root of the zygoma. Whiting especially recommends this procedure and says:

"That these osseous structures, investigation of which is usually disregarded, contribute to the necessity for secondary operation with a degree of frequency greater than is commonly ascribed to them, the writer thinks an entirely warrantable assertion, since in every instance where secondary operation has been required in his service (after the tip has been removed at the primary operation), the offending agents were found with uniform regularity, both by means of probing and later by inspection upon reopening the wound, in the anterior superior angle of the suprameatal triangle; in other words, in that portion of the temporal bone which constitutes the posterior root of the zygoma."

FIG. 91.—STACKE GUIDE.

The preliminary procedure differs in no wise from the simple mastoid operation with the exception that immediately following the separation of the cartilage, the bony meatus is widened in the superior portion by chiseling away a small amount of bone to give a better view of the field of operation. The small square opening is gradually enlarged in a funnel-shaped fashion directly into the antrum, found at a depth varying from one-eighth to three-quarters of an inch.

The opening into the antrum is gradually enlarged, the mastoid cells opened by the removal of successive layers of bone close to the

posterior wall of the meatus, forming the initial groove. As the layers of bone are chipped or curetted away with a sharp spoon, exploration should be made for sinuses leading to collections of pus. The characteristic of the pus which flows from the bone varies somewhat and when pulsating suggests disintegration of bone down to the dura of the brain. When great quantities of pus pour out, there is probably involvement of extensive areas of bone. Under

FIG. 92.—KERRISON'S TYMPANIC FORCEPS.

strong illumination from a head-mirror and a Stäcke's guide in the aditus as a protection against injuring the facial nerve and the semi-circular canals, the thin, bony wall separating the meatus from the antrum is chiseled away down to the thin bridge of bone separating the posterior and superior bony canal from the middle ear. This with the ossicles and necrotic tissue is

then removed with Rongeur or Kerrison's tympanic forceps, or the author's chisels. The floor of the tympanic cavity is then carefully cleansed of all debris. Any granulations about the Eustachian tube should be curetted away. In severe cases, before completing the operation, the roof of the antrum and the bone covering the sigmoid sinus should be carefully examined for any dark patches or perforations which are present in extra-dural abscess in the temporo-sphenoidal lobe or about the sigmoid sinus. All debris and septic material should be washed away with a hot saturated solution of boric acid. The bony cavity is lined, after the manner

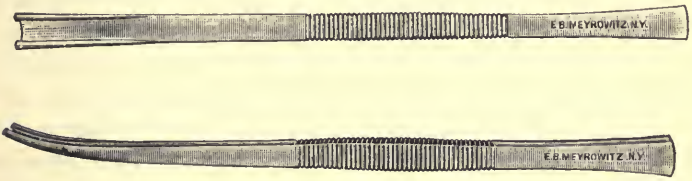

FIG. 93.—AUTHOR'S CHISELS DESIGNED TO PREVENT INJURY TO THE FACIAL NERVE IN REMOVING THE BRIDGE OF BONE, SEPARATING POSTERIOR OSSEOUS WALL FROM THE MIDDLE EAR.

of Whiting, with fenestrated rubber tissue and packed with gauze. Two or three stitches may be taken in the upper and lower lips of the wound, leaving the wound sufficiently open for easy packing. The dressing may be changed after twenty-four hours (Whiting) provided the rubber tissue is used. When gauze alone is used to pack the wound, it may remain for five days provided it does not become soggy and mixed with pus, when it should be repacked. The dressing should now be changed daily until recovery. Healing takes place by a process of granulation from the bottom upward. In consequence of the great deformity following the radical operation, plastic operations are recommended as a substitute for the method of plugging the post-auricular wound with strips of gauze. In the plastic operation the post-auricular wound is closed and healing takes place by first intention. By this method, little or no deformity results from the operation and recovery is much quicker than in the retained post-auricular opening.

In the Panse plastic operation, the posterior wall of the cartilage is split medially and a cross cut is made at right angles at the external meatus and the corners stitched into the post-auricular wound, which is immediately closed so that the opening into the excavated bony cavity is wide and easily accessible by way of the external auditory canal for subsequent dressing and packing with iodoform gauze. The floor of the wound is gradually covered with epidermis from the attached edge of the membranous canal.

In the Körner operation, two parallel incisions are made in the external wall, one at the superior portion of the membranous canal and the other at the lower portion of the canal. A tongue is formed by a vertical incision at the inner portion of the membranous canal. The tongue or flap is placed in the osseous canal and packed with gauze followed by closure of the retro-auricular wound. The tongue quickly adheres to the bone and by a process of extension soon covers the exposed portion of the canal. Subsequent dressings are the same as in other plastic operations.

The Stäcke Operation.—The Stäcke operation under the most rigid antiseptic precautions, consists in making a curved incision from the tip of the mastoid to the superior margin of the auricles, then forward to a line drawn vertically through the meatus. The incision is carried down to the periosteum. The hemorrhage is controlled with hemostatic forceps. With an Andrews speculum the lips of the wound are widely separated, the periosteum is separated from the bone, and the posterior wall of the canal is separated from the bony cavity down to the drum, with a periosteum elevator. Search should be made for the mastoid fossa or the spine of Henle and when once located, should be a guide into the mastoid antrum. With a leaden mallet and chisel (chisel varying from five mm. to eight mm. in width), with a Stäcke protector in the tympanic cavity to prevent injury to the facial nerve, the upper and outer wall of the meatus is chiseled away directly into the attic tympanicus without completely opening into the antrum. The cavity is illuminated by electric head-mirror. The ossicles and granulations are removed with small goose-neck forceps and curette. The antrum and cells are then opened in a reverse manner and necrotic tissue removed.

There remains but a single cavity when the operation is complete. The membranous meatus is split in the posterior portion and placed against the osseous meatus and retained in position by tampons of iodoform or bichlorid gauze. The posterior wound is closed and subsequent dressing is made through the meatus. The auricle and posterior wound are carefully dressed with a thick layer of gauze and cotton held in position by a bandage. The after-treatment is directed to keeping the wound in an antiseptic condition. The gauze dressing should be removed twenty-four hours following the operation and the wound dusted with iodoform and repacked. This treatment should be continued daily until repair is complete, which time varies from six to ten weeks.

Among the unfortunate accidents which may accompany anterectomy are wounding the facial nerve, the horizontal semi-circular canals and the lateral sinus. Only a close study of the position of these organs and a knowledge of the possible deviations from the normal will assist in preventing this accident, which is not an uncommon one.

Facial paralysis from neuritis may come on a few days after this operation and pass away in a very short time. A complete severing of the facial nerve will bring about paralysis which is usually permanent.

Accidental opening of the lateral sinus is not in itself dangerous to life and the hemorrhage is easily controlled by a tampon of bichlorid gauze. The suspension of operative measures may be necessary, though the majority of surgeons who meet with this accident tampon the wound and complete the operation.

Jansen's Modification of Stäcke's Operation.—Among the foreign operators recommending a plastic operation with a retention of the post-auricular opening are Panse, Siebenmann, Kretschmann, Schwartze, Jansen, Passow and Reinhart (Heine).

According to Heine, Jansen's modification of Stäcke's operation, as in the classical operation, consists in a cut in the skin parallel with the external ear, one-half cm. away, beginning at the upper attachment of the auricle and extending downward to the tip of the mastoid, through the skin and periosteum at one incision, and if

there is a large abscess, a small incision should be made to allow the escape of pus, after which the cut can be made through the skin and periosteum. This is followed by a search for any fistulæ which may lead to pockets of pus. The boundary for the operation is in front of the posterior bony wall of the meatus or anterior wall of the mas-

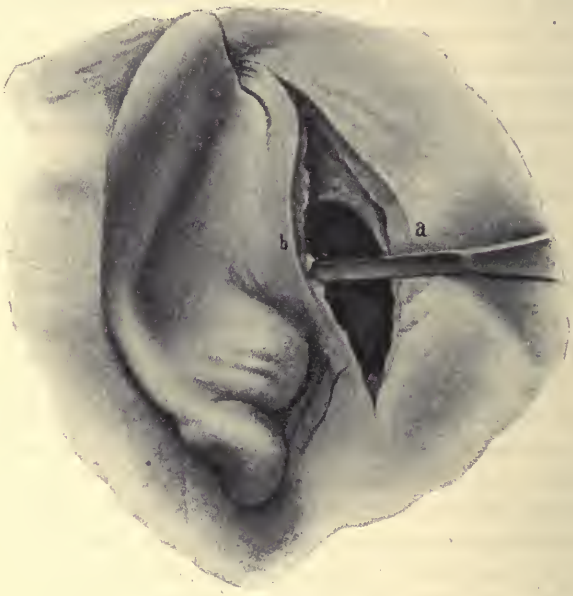

FIG. 94.—FIRST POSITION OF KNIFE IN JANSEN PLASTIC OPERATION.

a, Posterior border of post-auricular wound; *b*, anterior border of post-auricular wound. (After *Heine*.)

toid. The posterior boundary is an artificial one and a vertical line can be drawn from the tip of the mastoid to a line drawn through the horizontal temporal line (Fig. 94). This boundary only holds good at the beginning of the operation. Extract large but thin pieces of bone, always chiseling from behind forward, thus avoiding the possibility of going into the lateral sinus. All diseased bone and

debris of bone must be removed for a small splinter of bone may find lodgment in the sinuses. When the sinus is opened there will be great bleeding. If there is pus in the dura, it will come out pulsating. If there is much destruction of bone covering the dura, it should be removed as far as possible with bone forceps. If there is present a Bezold abscess, it should be opened and evacuated before

FIG. 95.—THIS FIGURE SHOWS THE KNIFE PASSED INTO THE AUDITORY CANAL PRELIMINARY TO THE DOWNWARD STROKE FOR THE FORMATION OF THE BUTTONHOLE IN THE MEMBRANOUS WALL.

a and *b*, Same as in foregoing figure; *c*, lateral border of perpendicular incision. (After *Heine*.)

proceeding with the radical mastoid operation. After cleansing the auditory canal and the wound of all diseased bone granulations, etc., the pinna is bent forward with a sharp knife from behind (Fig. 95), an incision is made from the roof of the meatus at the junction of the meatus with the pinna through the soft part down to the floor, and the wound is made to gap by stretching the wall outward and back-

ward (Fig. 96). The tampons are removed and a straight pair of strong scissors inserted through the vertical cut into the meatus, one blade in the meatus and the other in the external wound in such a way as to include as much as possible of the skin of the meatus; with one cut the skin is severed horizontally at the boundary of the

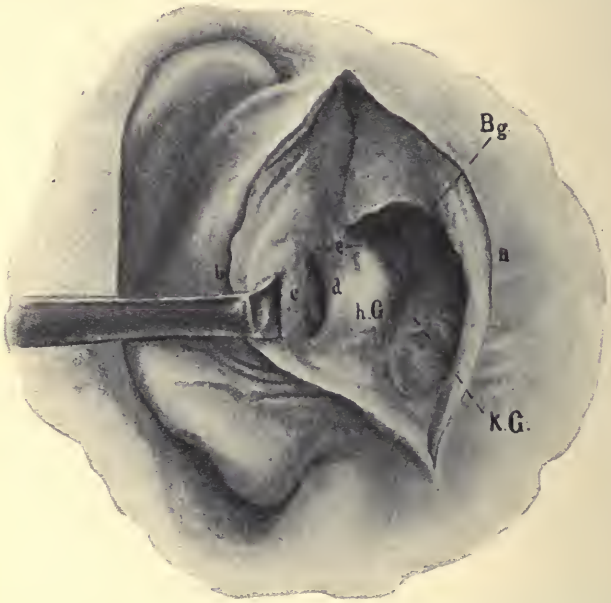

FIG. 96.—*a*, *b*, *c*, Same as in Fig. 95; *d*, median border of perpendicular incision; *e*, line of horizontal incision for formation of flaps; *hG*, posterior membranous wall; *KG*, part of posterior bony wall of auditory canal; *Bg*, horizontal semicircular canal. (After *Heine*.)

posterior and superior wall of the meatus in its long diameter. Bleeding, which may be profuse for a short time, is controlled with a clamp. If the lateral part of the flap is too thick, some of the soft parts may be removed down to the skin after the field is cleansed of blood.

With a pair of forceps, the flap is carried backward and inward and spread upon the bone extending into the hollow of the bone as far as possible. The flap is kept in this position by tamponades.

Care should be taken not to divide the pinna too far forward. Tampons should be applied quickly to prevent oozing of blood which is quite free. The tampons in the drum are removed, and with forceps strips of iodoform gauze are inserted into the post-auricular opening with the right hand, the lamina being held in position with the left. The hollow of the operation is now tamponed until full to the rim.

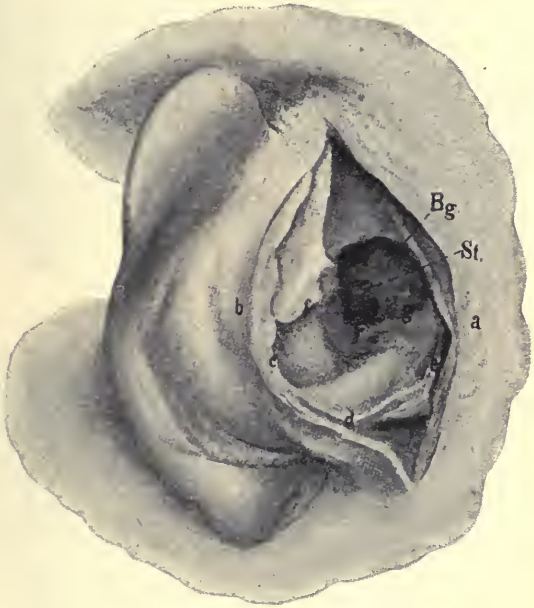

FIG. 97.—*a*, *b*, *c*, *d*, *Bg*, Same as in Fig. 96; *f*, anterior border; *e*, posterior border of horizontal incision; the flap (*d*, *e*, *g*) is laid back; *d*, lateral; *e*, posterior; *g*, median border of flap; *St*, stapes. (After *Heine*.)

The ear is turned back and several strips of gauze are inserted into the meatus, which press against the lamina.

The plastic operation cannot always be done when the bone is diseased or the condition of the bone is not perfectly sound. The flap will not heal and will probably suppurate, where gangrene, or a septic disease of the bone, is present.

Post-operative treatment depends upon conditions. Syphilis, inherited cachexia and exanthematous diseases accompanying the disease require special treatment.

The first dressing should not be changed for eight days and the patient should be confined to bed for that length of time. Fever,

FIG. 98.

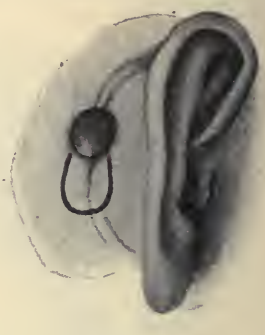

FIG. 99.

FIG. 100.

FIG. 101.

PLASTIC CLOSURE OF PERSISTENT POST-AURICULAR OPENINGS. (Modified after *Mosetig-Moorhof.*)

pain, discharge and iodoform eczema may indicate earlier change of dressing. A little variation of temperature does not amount to much and is not suggestive of infection. A second dressing should be made after three or four days and after that once daily. Do not tampon too tightly. The dressing should be changed earlier if the

FIG. 102.

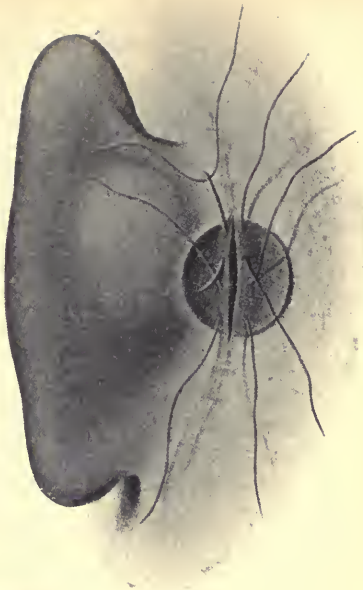

FIG. 103.

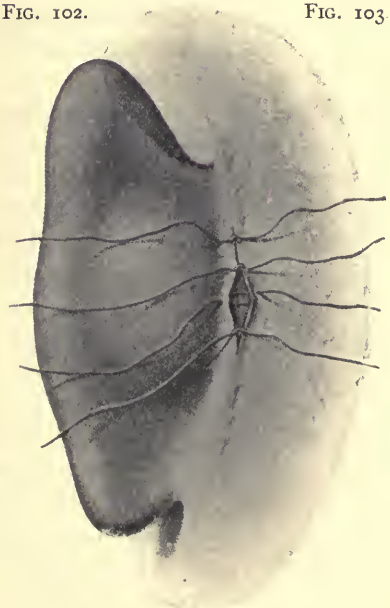

FIG. 104.

PLASTIC CLOSURE OF PERSISTENT POST-AURICULAR OPENINGS. (After *Trautmann.*)

secretion is seen through the gauze. The gauze should be damp but not wet and soggy. Slight dizziness may continue for a number of days and even mental aberration as described by Grossman, which is probably due to concussion of the brain and labyrinth from chiseling and not unlikely absorption of toxins from the wound.

Method for Closing Persistent Retro-auricular Opening Produced by Radical Operation.—The plastic operation recommended by Mosetig-Moorhof, which is shown in Figs. 98, 99, 100 and 101, is as follows:

Under careful antisepsis, a tongue-shaped incision is made below the retro-auricular opening, slightly larger than the original opening. The author recommends that the size of the flap be outlined with a pencil before incision is made. A groove is dissected around the periphery of the opening, as shown in Fig. 98, with a sharp, pointed knife. The flap is turned upward with the epidermis pointed inward and stitched into the wound with four stitches. The skin at the site of the dissection of the flap is brought together by stitches as shown in Fig. 101. The raw surface of the flap is covered with Thiersch's graft or allowed to heal by cicatrization.

In Trautmann's method, the skin is anesthetized with Schleich's mixture and an oval incision is made about 4 mm. distant from the periphery of the opening as in Fig. 102, forming two flaps. These are turned inward and retained by sutures, as shown in Fig. 103, the epidermis is thus opened inward. The external flaps are brought together as shown in Fig. 104. This method may be used in both large and small openings.

CHAPTER XIV.

COMPLICATIONS OF MIDDLE EAR SUPPURATION.

Granulations in the Middle Ear and Mastoid Cells.—Granulation tissue frequently appears during the course of middle ear suppuration. In structure, the granulations are made up of round cells and new blood vessels and covered with flat or columnar ciliated epithelium, sometimes containing crystals of cholesterin.

Deep, red granulations stand out distinctly and have a tendency to bleed upon pressure with a probe. In tubercular inflammation, the granulation tissue may appear pale, glistening and edematous. The site of the granulations varies and may cover the entire surface of the middle ear or may be limited to some portion of the mucous membrane of the walls, the mouth of the Eustachian tube or the ossicular chain.

Treatment.—For the prevention of granulations and their removal, alcohol in increasing strength, beginning with a twenty-five to fifty per cent. solution, should be applied once or twice daily. By a process of graduation, the patient will frequently be able to use the alcohol in full strength. The granulations may be destroyed by cauterization with a fifty per cent. solution of chromic acid. The caustics should be applied directly on the granulations and not diffused over the surface of the mucosa. The surface should be anesthetized with a four per cent. solution of cocain previous to the application of the caustics or galvano-cautery. A very satisfactory method for removal of granulations is curettement with a sharp spoon devised by O. Wolf. Curettement should be followed by the instillation of a saturated solution of boracic acid in fifty per cent. alcohol, until recovery is complete.

Polypi.—Two fundamental forms of polypi of the ear are described by Görke as granulation tumors and mucous polypi. They may become encysted, containing giant cells and sometimes cholesterin

crystals (Manasse). Polypi are the product of a desquamative inflammation and occur more often in middle ear suppuration. From the two fundamental forms described by Görke, may be developed myxomata and angio-fibromata.

Polypi may take their origin in any portion of the middle ear or membrana tympani, but more frequently from the inner walls, ossicles or attic and infrequently from the external auditory canal. They may be single or multiple in number and sessile or pedunculated. Zaufal and Gottstein report the occurrence of polypi in the tympanic cavity without perforation of the drum (Politzer). As a rule, polypi are detected protruding through the perforation in the drum and are deep red and glistening in appearance. The growth may be moved about and differentiated with a blunt-pointed probe. Polypi may also form in the tegmen tympani as a result of erosin of bone due to the presence of a chronic, circumscribed cerebral abscess or to the granular tissue thrown up by the dura as a safeguard against extension of infection and inflammation to the meninges in an old suppuration in the middle ear. The removal of such granulations or polypi may expose the meninges and predispose the patient to infective leptomeningitis.

Symptomatology.—The symptoms are more often those of chronic otitis media purulenta. Where the polypi protrude through the membrana tympani or Shrapnell's membrane, pus may be dammed back into the attic and the patient may complain of headache, dizziness and nausea from absorption of toxins and pressure of accumulated pus.

Diagnosis.—The external auditory canal is first freed of all pus and debris by irrigation with a warm lysol solution and dried with cotton, after which the diagnosis of aural polypi is comparatively easy. The diagnosis is not always simple as shown by the report of a case by Schultze, of aneurism of the carotid, which was mistaken and operated on for polypus.

The character of the growth may be differentiated under good illumination with a blunt-pointed probe. The application of cocain may cause a small and pedunculated polypus to shrink and recede through the perforation of the drum.

Treatment.—The most satisfactory method of removal is by curettement with a Wolf's spoon, followed by the daily application of alcohol in increasing strength, beginning with a twenty to fifty per cent. solution. A Blake's snare may be used when the tumor is large. The application of perchlorid of iron by means of a probe is highly recommended.

Alcohol in full strength will frequently bring about complete shrinkage. The alcohol is to be instilled into the ear twice daily until the polypus is destroyed.

Necrosis of the Ossicles.—Necrosis of the ossicles may be partial or complete and occurs more often in the incus, the malleus being involved next in frequency. The foot plate of the stapes is infrequently diseased. Very often when the perforation is through Shrapnell's membrane, the head of the malleus only will be involved. The necrosis may only invade to the incudo-stapedial articulation. If there is total destruction of the membrana tympani, free access is had to the attic of the middle ear.

Treatment.—When local treatment has failed to cure the purulent discharge in a chronic, purulent inflammation without involvement of the mastoid antrum, ossiculectomy should be performed. Ossiculectomy consists in the complete extirpation of the ossicles. The operation may be performed under a local or general anesthetic. The auditory canal is first thoroughly cleansed with a warm solution of bichlorid of mercury, 1/5,000, or a solution of lysol, one drachm to a pint of warm water. The canal and middle ear are then dried with cotton, followed by the application of adrenalin, 1/1,000, to prevent hemorrhage. As a local anesthetic, cocain in a 20 per cent. solution is recommended. For a general anesthetic chloroform of nitrous oxid gas may be used. An incision is made with an angular knife extending from the posterior lower quadrant of the drum, following the periphery upward to the short process and then curving downward to the middle of the drum along the long process of the malleus. By turning down the flap, the incudo-stapedial articulation is brought into view. This is severed with a small, pointed knife. The incision is then extended into the anterior periphery of the tympanum to the membrana flaccida, which is incised together with the anterior

and posterior ligaments binding the malleus. The malleus is then grasped below the short process by McKay's ear forceps, and by gently rocking back and forth, it is detached and extracted. The incus is next extracted. It may drop down into the tympanic cavity and can then be removed by a short, curved, blunt hook. If it is desired to remove the stapes, the short-hooked instrument is inserted into the foramen of the stapes, which is extracted by gentle traction to avoid fracture. The tympanic cavity is thoroughly dried, dusted with iodoform and iodoform gauze is inserted for drainage. Subsequent treatment is directed to the dressing and cleansing of the ear until recovery is complete.

Facial Nerve Paralysis.—*Etiology.*—The etiology of facial paralysis of an otogenous variety is, as demonstrated in the previous consideration of the disease of the ear, due to acute otitis media, chronic or acute otitis media purulenta, exfoliation of the cochlea, necrosis and caries of the temporal bone, paracentesis, trauma from opening the accessory cavities of the middle ear, tumors and entrance of foreign bodies through the external auditory canal, or gunshot wounds of the temporal bone.

Pathology.—The wall of the canalis Fallopiæ and facial nerve within are injured or exposed to infection from disease or trauma. The perineurium or nerve sheath enclosing bundles of fibers may become infiltrated with hemorrhagic extravasations or pus, producing partial or total paralysis from destruction of nerve fibers.

Symptomatology.—Paralysis of the facial nerve may be partial or complete. There is a distortion of the face and drawing to the opposite side, the upper eyelid droops and the patient may be compelled to open the eye by lifting the upper lid with the finger. The soft palate is drawn to the opposite side. There may be disturbance of the taste and dryness of the mouth, both conditions due to the involvement of the chorda tympani nerve. Deafness and tinnitus may be due to paralysis of the stapedius muscle, which permits the foot-plate of the stapes to be driven deep into the oval window by the tensor tympani muscle.

Course and Prognosis.—The prognosis is more favorable in children than in adults. The prognosis is unfavorable where there is com-

plete destruction of the nerve from suppuration. In partial injury to the nerve, recovery will often be complete in from six to ten weeks.

Treatment.—After the removal of the cause, the course of the treatment is very satisfactory. Strychnin hypodermatically in one-thirtieth grain doses, once daily, faradic electricity as an adjunct to surgical measures and constitutional treatment are recommended.

Cholesteatoma of the Middle Ear and Mastoid.—There is at present a division of opinion in regard to the pathogenesis of cholesteatoma of the middle ear and accessory cavities.

In 1838 Johannes Müller accentuated the investigation of Cruveilhier, who was the first to call attention to the pearl-like formations by discovering that the pearly bodies contained cholesterin and were made up of laminated squamous cells.

Haberman, Bezold and most writers believe that the presence of the layers of squamous epithelial cells within the middle ear is due to migration of the cells from the external auditory canal.

According to Virchow, Bostrom and others, the presence of squamous cells in tissue of unlike structure is due to a process of fetal inclusion.

Politzer believes cholesteatoma may originate in the middle ear and cites the case reported by Lucæ. However, he says that the great majority of cases are secondary.

There is a well-grounded belief that the migration of cells into the middle ear may have taken place during an early attack of inflammation of the middle ear followed by perforation, in which the perforation subsequently closed.

Cholesterin growths in the auditory canal may involve the mastoid process by pressure and a softening of the bone and a like growth of the mastoid process may break through the posterior wall of the auditory canal.

Grunert reports a case of cholesteatoma which destroyed the anterior bony wall of the canal and passed into the fossa glenoidalis of the lower jaw. The case of Barnick is mentioned by Grunert (*Annals of Otology, Rhinology and Laryngology*, June, 1904), in which a cholesteatoma of the mastoid was changed into a cyst containing blood.

Cholesteatomata are divided into primary and secondary; the primary form originating in the auditory canal, middle ear, mastoid process or meninges independent of any previous inflammatory changes.

As the name implies, the secondary form is a sequence of some inflammatory change at or near the site of the lesion.

Etiology.—The exact etiology of cholesteatomata is somewhat obscure. The primary form of the disease is probably induced by some local or general irritation or by some trophic disturbance. The secondary form is induced by a persistent inflammation which brings about a proliferation of the epithelial cells of the meatus with the formation of laminated non-nucleated cells arranged concentrically.

Diagnosis.—The disease may continue for a very long time without bringing about irritation by pressure. When obstruction of the auditory canal, middle ear and mastoid is established, the patient complains of deafness, tinnitus aurium, dull pain in the ear or side of head, and in severe cases, nausea and vomiting.

Examination of the auditory canal may show the cholesteatomata filling the canal or protruding from some portion of the tympanic membrane. The patient complains of a foul-smelling discharge from the ear where the disease is secondary to a chronic inflammation. Examination shows the mass to be cheese-like, somewhat round and of a pearly whiteness or yellowish-white appearance. The washings from the ear many appear stringy or clumpy.

Microscopically, the mucus contains cholesterin, crystals of fatty acid, non-nucleated, laminated, squamous epithelium and debris.

Prognosis.—The disease seldom or never disappears spontaneously and in consequence of the tendency to grow and destroy important structures, the prognosis is grave unless the disease is completely removed by mechanical means. In involvement of the temporal bone, there is always the possibility of lateral sinus involvement, meningitis and a cerebral abscess. If the disease is confined to the external auditory canal without involvement of the osseous structure, the prognosis is favorable. The disease shows a tendency to recur.

Treatment.—Provided it cannot be removed by softening with peroxid of hydrogen and irrigation, it may sometimes be possible

to curette the mass away. The radical tympano-mastoid operation is necessary in suppurative affections of the mastoid.

As in the case of Dudley, where the cholesteatomatous masses involve the external auditory canal and mastoid process, the mastoid and auditory canal may be opened and curetted of all the disease without entering the tympanic cavity.

The lines of the operation will be suggested by the position and extent of the disease in every case.

The local treatment consists in flushing the diseased area with a fifty per cent. solution of camphoroxol, which has a tendency to check the epithelial desquamation.

Caries and Necrosis of the Temporal Bone.—Caries and necrosis are more frequently a concomitant condition of acute or chronic suppuration of the middle ear, in which there was primary involvement of the bone accompanying inflammation of the mucous membrane. Other causes of disease of the bone are trauma, syphilis, osteomyelitis, gunshot, diabetes and tuberculosis of the bone. Caries more often attacks the cancellous, and necrosis the compact portion of the bone. The portions of bone more frequently involved are the mastoid process, ossicles, posterior and superior walls, roof or tegmen tympani and superior half of the auditory canal. The pus, from retention or pressure, may burrow its way through the attic or tegmen tympani into the middle cranial fossa, the labyrinth, and the soft tissue about the auricles, into the naso-pharynx or lateral sinus.

The amount of destruction of tissue is variable, depending upon the exciting cause and the course of treatment and may be only a small superficial sequestrum or extensive destruction of tissue. The fluids of the labyrinth may escape, producing total deafness, when the external wall of the labyrinth becomes necrotic. The head of the malleus and incus are often involved in caries of the tegmen tympani. They may slowly dissolve in the pus or become detached and are washed away in irrigating the ear.

Symptomatology.—Pain is often present in and about the auricle and is due to retention of pus and inflammation of the bone, being more pronounced at night. The discharge from the ear is copious and usually fetid and is due to the entrance of saprophytic bacteria.

In necrosis of the labyrinth, the patient may complain of nausea, vomiting, tendency to fall to the affected side, facial paralysis and neuralgia. Pain may be very slight or absent in caries and necrosis due to tuberculosis. Bone sands may be thrown down by precipitation. The temperature may vary from slightly above the normal to 105°. Where there is marked necrosis as in acute osteomyelitis, the pain is of a deep boring character. Tinnitus and deafness are usually present.

Upon inspection of the auditory canal, there is usually a thick, profuse, fetid discharge with ulceration of the mucous membrane about the tympanic ring and possibly collapse of the superior portion of the osseous wall of the canal with one or more fistulous openings. Granulations and polypi are usually present. Pus may reach the parotid gland and the anterior portion of the ear and angle of the jaw through the fissure of Santorini. Complications of this character are not infrequently observed in children.

Diagnosis.—Deep boring pain about the auricle and side of the head is suggestive of bone involvement in chronic otitis media. After irrigation of the auditory canal, the condition of the middle ear and osseous portion of the auditory canal should be explored with a cotton-tipped probe. The cotton-tipped probe enables one to detect necrotic bone by the grating sensation produced by the cotton catching on the spicula of bone.

A condition of slumbering necrosis may involve the mastoid after all discharge from the canal has stopped and the perforation closed. This condition may continue for an indefinite period with slight symptoms of pain in the mastoid and tenderness upon pressure. The drum head may subsequently rupture from accumulation of pus in the middle ear, only to close again in a short time.

Incision and exploration of pus sacs about the auricle will favor the detection of necrotic bone. Care must be exercised not to injure the dura mater with a probe in the examination. Recurrent and severe attacks of peritonsillar abscess at the time of aural infection should be looked upon with a suspicion of necrosis in the bone about the middle ear. Involvement of the labyrinth is detected by the loss of bone conduction, deafness, vomiting, staggering gait and paralysis

of the seventh nerve. Fistulous opening of the mastoid may permit exploration with a probe and the discovery of a sequestrum.

In involvement of the antrum, there may be bulging of the superior and posterior osseous walls.

Granulations and polypi usually follow necrosis and may be seen filling the meatus. In the absence of temperature, the possibilities are that the leucocytes will be below the normal in number and more or less anemia will be present. Leucocytes of the polymorphonuclear variety will be found in cases with rapid necrosis and high temperature.

Prognosis.—In the absence of brain involvement, the prognosis is favorable. Sequestra may be thrown off and the bone entirely healed by a process of granulation. The prognosis is doubtful in necrosis and caries as shown by the blood examination and indications of brain involvement, pyemia or metastatic inflammation. Fatal hemorrhage may occur from invasion of the carotid canal. Leptomeningitis may occur from invasion of infection into, and involvement, of the carotid wall, producing death. Necrosis of the carotid wall occurs more frequently at the site of the change of the direction of the carotid from the vertical to the horizontal direction, known as Hassler's site of predilection.

Treatment.—The general treatment is directed to the building up of the usually debilitated system by rest in bed and the administration of tonics and alteratives.

The local treatment is first directed to the removal of all accumulation in the auditory canal with a warm lysol solution, one drachm to the pint of warm water, followed by drying with a cotton-tipped probe.

Exuberant granulations and polypi should be removed with a curette.

Fistulous abscess about the auricle should be opened and inspected for dead bone, all of which should be curetted away.

After the establishment of free drainage by the removal of granulations and necrotic tissue in the middle ear, the spread of infection to the pharynx, parotid gland, etc., may be prevented by the spontaneous healing which takes place in the channel of communication.

The ear should be irrigated twice daily with a warm lysol solution and tamponed lightly with antiseptic gauze. The radical mastoid operation (described in the previous chapter) is indicated where there is involvement of the mastoid process and tegmen tympani.

When the outer wall of the mastoid process has been removed, the subcutaneous injection of paraffin will somewhat overcome the deformity which follows.

Meningitis.—Meningitis is subdivided into pachymeningitis or sub-dural abscess, and leptomeningitis or diffuse serous, or septic meningitis.

The avenue of infection in leptomeningitis is often through the tegmen tympani et antri, the sigmoid sinus, the carotid channel, the labyrinth, the facial canal or the lymph sheath of anastomosing blood vessels and is due to erosin of bone from otitis media purulenta. Leptomeningitis is subdivided into two forms, serous and purulent.

Serous Leptomeningitis.—Serous leptomeningitis of an otitic origin is characterized by a local or general hyperemia, followed by a serous exudatian into the pia mater. The ventricles and dura mater become distended from an increase of cerebro-spinal fluid. Suppuration in the labyrinth is a frequent cause of serous meningitis (Jansen and Politzer). Lumbar puncture and opening the dura at the site of the necrosis, is usually the best form of treatment in serous meningitis. The serous meningitis of Quincke is suddenly, during the seemingly satisfactory course of the ear disease, ushered in with high temperature, rapid pulse, delirium, and symptoms of pressure in the posterior fossa. There may be present optic neuritis and strabismus. According to Quincke, opening into the arachnoid space will be followed by a cure.

Purulent Leptomeningitis.—In purulent leptomeningitis the serous exudation becomes filled with leucocytes, changing rapidly to sero-pus. The brain substance may become infiltrated and softened.

Symptomatology.—The important symptoms in the course of middle ear suppuration are a rapid polynuclear leucocytosis, headache, which is at first remittent and localized, finally becoming severe, persistent and generalized, restlessness, insomnia, hyperesthesia of the cutaneous nerves, full and rapid pulse, rise of temperature and

loss of consciousness. The pupils are retracted and do not react to light. The pulse is slow in the later stages of the disease, becoming rapid in the last stage. The pupils become dilated, with involuntary voidance of urine and feces. In lumbar puncture, the fluid will be turbid in color, and filled with cells and microörganisms. General paralysis supervenes, followed by death.

Course.—The course of the disease may be rapid or slow. Meningitis following acute purulent middle ear inflammation is more rapid, ending in death in two or three days. Following a chronic purulent inflammation, death may occur after a number of weeks.

Prognosis.—The prognosis is favorable when operation is performed early in the disease. Purulent leptomeningitis without operation usually ends in death.

Treatment.—The treatment is the same as for pachymeningitis or subdural abscess. Lumbar puncture will frequently give immediate relief. This should be repeated when relief follows this form of treatment. The amount to be withdrawn at each puncture should be from 20–40 c.c. to be repeated daily.

Thrombosis of the Lateral Sinuses.—This condition more frequently results from necrosis of the inner wall of the antrum and subsequent phlebitis and formation of a thrombus. There is always danger of pyemia and metastatic abscess from infection reaching the blood stream. Primary jugular bulb thrombosis is often encountered and is due to infection spreading primarily through the floor of the tympanic cavity to the bulb. This condition is more often observed in children suffering from acute otitis media suppurativa, and in those cases where the jugular bulb is in close proximity to the floor of the tympanic cavity.

Symptomatology.—The following group of symptoms are those enumerated by Ballance, and when present are pathognomonic of septic thrombosis. (1) The history of purulent discharge from the ear for a period of more than a year; (2) sudden onset of the illness with headache, vomiting, rigor and pain in the affected ear; (3) the oscillating temperature; (4) vomiting, repeated day by day; (5) second, third or more rigors; (6) local edema and tenderness over the mastoid or in the course of the internal jugular; (7) tenderness

on pressure at the posterior border of the mastoid and below the external occipital protuberance; (8) stiffness of the muscles of the side of the neck; (9) optic neuritis. In addition to the above, the examination of the blood shows a rapid increase of white corpuscles varying from sixteen thousand to twenty-five thousand or more.

Diagnosis.—On account of the frequent complication of and resemblance to meningitis or cerebral abscess, the diagnosis is somewhat difficult and is dependent upon the symptoms as enumerated above.

Treatment.—The treatment is necessarily operative and consists as far as possible in the complete exposure and removal of the focus of infection and the prevention of extension of infection through the circulation. Operative measures should be instituted as soon as the surgeon is convinced that the septic thrombosis exists. The question of early ligation of the internal jugular vein for the prevention of the spread of infection is still an open question. According to Bacon, the general opinion is in favor of tying the vein in all cases in which the sinus contains putrid material, pus, disintegrated thrombus, as well as in those cases in which the presence of the thrombus in the internal jugular is evident from the cord-like induration felt under the border of the internal mastoid muscles.

The following surgical procedure is recommended by Jacobson and Steward, page 257, and is copied verbatim:

"This is carried out by first turning back an appropriate flap, freely opening and clearing out the mastoid cells and then enlarging the opening backward to the point in Fig. 103. 'It is usually found one-quarter of an inch, though it may be only one-twelfth of an inch from the surface. It is thus much more superficial than the antrum. The anterior line of the sinus is situated from one-eighth to a quarter of an inch behind the case-line of the supra-meatal triangle' (Macewen). As soon as the groove for the sinus is opened, foul pus or gas may escape. The condition of the sinus is investigated, the question of plugging being cleared up by an exploring needle, which, when withdrawn, may smell foully, though empty. If a thrombus is present, before the surgeon proceeds further he should tie the internal jugular vein, at the level of the hyoid bone, with two chromic gut ligatures, and divide the vein between them. If the vessel is thrombosed

at this point, the ligature should be placed lower down at a point beyond the clot; but the prognosis is here less favorable. The bony outer wall of the lateral sinus having been thoroughly cut away, the sinus itself is opened with sharp scissors and all the offensive clot within reach cleared out by the sharp spoon, curette or a syringe with a fine nozzle. If, after this is done, blood begins to flow from either end, it is per se a favorable sign, as it shows that the clotting does not extend far into the collateral vessels. There will be no difficulty in dealing with any hemorrhage from the lateral sinus provided there be room for dealing with it by means of a sufficient opening in the skull. Firm plugging with strips of iodoform gauze wrung out of carbolic acid (1 in 20), and over this a dressing of aseptic wool and a knotted bandage, will arrest any hemorrhage, however free; as occurred in one of my cases, this hemorrhage may recur freely during the first few dressings but without any ultimate untoward result. Constant irrigation with mercury-perchlorid solution (1 in 4,000) should be employed and iodoform thorougly used."

In one of Ballance's cases, though the patient's condition was greatly improved by the operation, the evidence of pyemia (blood-stained expectoration and swelling of some of the joints) persisted. Ten days after the first operation, as pus could be forced out of the opening in the sinus by pressure on the neck, an incision was made down to the vein, at the lower border of the parotid gland. The vessel was opened and pus came out; the sinus and vein were then irrigated with perchlorid solution, the stream passing in either direction and bringing away offensive clots. The man recovered.

The following directions for dealing with the sinus are given by Professor Macewen (loc. supra cit., p. 309):

"Frequently, in opening the sigmoid groove, granulation matter protrudes from the dura mater covering the sinus, and often along with this, there is oozing of pus. If it be considered advisable to open the sigmoid sinus and turn out its disintegrating contents, then fully a vertical inch of the sinus ought to be exposed before opening it, in order to facilitate the operation and the measures necessary for its obliteration. Occasionally the wall of the sinus next to the bone is ulcerated and, the sigmoid groove being opened, the contents

of the sinus become exposed to view, when the disintegrating matter may be removed with the aid of a small spoon or washed out—the former is the safer. Any space existing between the sigmoid groove and the sinus ought likewise to be cleared out and rendered aseptic. Granulation tissue protruding from the dura mater ought first to be carefully examined with a probe, lest it surround a sinus communicating with the cerebellum and leading into an abscess. If such a sinus exists it requires to be opened and the cerebellar abscess dealt with. If there be no sinus, the granulation tissue ought to be removed, as it is apt to harbor infective matter.

"To obliterate the lumen of the sinus its external walls, which were previously split, are folded inward. A quantity of iodoform and boracic acid powder, sufficient to fill the interior of the cavity existing between the obliterated sinus and the bone, is introduced, care being taken in so doing not to exert so much pressure as to strip the sinus or surrounding dura from the skull. As in these cases an infective wound is being dealt with, the external portions of it are best stuffed with iodoform gauze, so as to permit free drainage and healing by granulation tissue. To obliterate the sigmoid sinus over about an inch of its extent with influx of blood from the lateral and superior petrosal sinuses is arrested and the efflux through the mastoid vein is likewise cut off."

Extradural Abscess.—According to Politzer, extradural abscess occurs more frequently in acute than chronic middle ear suppuration and is often due to influenza.

Etiology.—The cause of an extradural abscess is the extension of infection from the middle ear and accessory cavities, necrosis of bone or infection through the blood and lymph streams. The size of the abscess and the amount of caries of bone varies in individuals. Extradural abscess may occur synchronously with abscess of the middle ear, yet independently, the affection originating in some other locality.

Symptomatology.—The symptoms of extradural abscess are somewhat obscure and it is often difficult to differentiate the disease. Severe pain and tenderness over the temporal region or mastoid process in acute and chronic suppuration of the middle ear, with a

rise of temperature to 103–104° F., cold and clammy condition of the skin, constipation, stupor, which sometimes passes to a point of coma, dizziness, vomiting and occasionally optic neuritis are suggestive symptoms of pachymeningitis, in which case an exploratory incision for the detection of an abscess is altogether advisable. An extradural abscess may sometimes empty through a perforation in the tegmen tympani, from a process of osseous erosin, and in consequence, the case may resemble one suffering from a profuse otorrhea (see Macewen, page 82). As observed by Takabatake, it may sometimes occur that an abscess of this character situated in the temporal lobe without demonstrative lesion of the dura, may produce crossed paralysis and disturbances of sensibility; and when situated on the left side, sensory disturbances of speech, probably due to a toxic meningo-encephalitis, originating in an infectious focus of pus and healing after the evacuation of the original collection of pus (*Archives of Otology*, Vol. 35, No. 5).

Treatment.—The incision behind the auricle is the same as that for anterectomy. In involvement of the temporal lobe, the incision should be carried upward, forward and anterior to the superior insertion of the auricle, permitting the auricle to be turned forward and downward. The temporal lobe may be directly exposed by trephining primarily through the temporal bone above the bony meatus or secondarily by exposing the antrum and removing the roof of the tympanum, as in the Stäcke operation (see Treatment of Mastoid Disease).

Abscess of the Brain and Cerebellum.—The etiology of brain abscess is the same as that of abscess in any part of the body. The important factors in the etiology are traumatism, disease of the accessory sinuses of the nose, especially the frontal, ethmoidal and sphenoidal sinuses, and acute or chronic suppuration in or about the ear. The avenue of infection may be through diseased bone or the lymph or blood streams.

Autogentic brain abscesses are probably metastatic in character and according to Von Bergmann, are usually located upon the side complained of.

The location of a cerebral or cerebellar abscess of a nasal or otitic

origin is in close proximity, as a rule, to the diseased bone, thus an abscess of the middle cranial fossa is usually situated close to the *tegmina tympani et antri.* Körner reports that in one hundred cases of abscess of the brain, secondary to diseases of the ear, sixty-two were located in the cerebrum, thirty-two in the cerebellum and six in both the cerebellum and cerebrum. The disease is frequently observed in chronic purulent inflammation of the middle ear and is due to necrosis of the bone and extension of septic infection into the brain tissue. The white substance is more often involved and may be acute or chronic. Among the various organisms found in brain abscess are the streptococci, staphylococci, diplococci, bacillus pyocyaneus, colon bacillus, bacillus meningitis purulenta and occasionally saprophytes.

Symptomatology.—The symptoms of cerebral or cerebellar abscess accompanying chronic purulent inflammation of the middle ear are the sudden rise of temperature which lasts for a short time, followed by normal or subnormal temperature, intense headache, vomiting, more or less stupor, slowness of speech and mental dullness, which may end in coma. Convulsions and paralysis sometimes exist. Babinski's sign may be present. The temperature is seldom very high and is more often subnormal. Tenderness is discernible upon percussion from the mastoid or squamous portion of the temporal bone.

In abscess of the temporal region of the left side, visual and auditory aphasia may be present. It may exist in the tract between the center of visual memory, and auditory memory; sounds are thus heard but not associated with certain objects, or seen and not recognized.

The aphasias most frequent are those known as motor and sensory aphasia, paraphasia and conduction aphasia. In conduction aphasia, there is presumed to be a disease of the island of Reil, which prevents the individual recalling words and causes the use of wrong words (Gowers). Agraphia, or the inability to express words in writing, and alexia, or word blindness, may be present if the disease is present on the left side and extends to the region of the angular gyrus.

Sensory aphasia is less frequently observed than motor aphasia. The auditory center is placed in the middle of the first temporo-sphenoidal convolution of the left side; however, there seems to be a relationship existing between the corresponding convolution on the right side and the auditory nerve of the left side and vice versa; thus, the disease of the right side in the region of the middle of the temporo-sphenoidal convolution, may produce deafness in the left ear as well as in the right.

In the diagnosis of the presence of sensory aphasia, the history of any previous deafness must not be overlooked.

Exploration of the cerebellum through the mastoid antrum is indicated upon failure to find pus upon exploration in the temporo-sphenoidal lobe. In lumbar puncture, in brain abscess there is no increase of leucocytes in the cerebrospinal fluid, whereas, in meningitis, there is an increase of leucocytes over the normal.

Treatment.—It is well to remember that an abscess of the temporo-sphenoidal lobe may rupture through the roof of the middle ear and drain perfectly, going to complete recovery. Abscess of the cerebellum may sometimes drain through a fistula in the mastoid process, as reported by Macewen. Certain well-established rules are laid down for trephining a temporo-sphenoidal abscess. By referring to Fig. 105 (Jacobson and Steward), the student will get a correct idea of the line laid down by Barker. The side of the head should be rendered aseptic as far as possible, by shaving and washing with soap, water and alcohol.

The incision should extend from the tip of the mastoid to the superior insertion of the auricle and somewhat forward. The mastoid cells are opened and cleansed of any necrotic tissue. A search should be made with a Macewen seeker for any fistulous track connecting the roof of the antrum and the tympanum with an abscess of the temporo-sphenoidal lobe. According to Macewen, the opening may sometimes be enlarged and the abscess drained through the fistulous opening. No fistulous track existing, the trephine may be applied to the skull at a point indicated in the illustration. After trephining, the dura mater will bulge forward without pulsation in a well-developed abscess of the brain. Small, deep-seated abscesses

may exist, according to Macewen, at a deeper level without any diminution of the cerebral pulsation. In extradural abscess, pus

FIG. 105.—THE FIGURE SHOWS THE RELATIONS OF THE LATERAL SINUS TO THE OUTER WALL OF THE SKULL AND THE POSITION OF THE TREPHINE. OPENING, *a*, FOR EXPLORING IT.

Reid's base line is shown passing through the middle of the external auditory meatus and touching the lower margin of the orbit. *x–x* indicates the site of the tentorium as far as it is in relation to the outer wall of the skull. The anterior *x* shows the point where the tentorium leaves the skull and is attached to the upper border of the petrous bone. *a*, Trephine opening to expose lateral sinus, its center being one inch behind and one-quarter inch above the center of the meatus. This opening can easily be enlarged upward, backward, downward and forward (see dotted lines) by suitable angular forceps. It is always well to extend it forward so as to open up the mastoid antrum, *c*. *b*, Trephine opening to explore the anterior surface of the petrous bone, the roof of the tympanum and the petro-squamous fissure, its center being situated a short inch above the center of the meatus. At the lower margin of this trephine opening, a probe can be insinuated between the dura and the bone and made to search the whole of the anterior surface of the petrous. *c*, Trephine opening for exposing antrum, one-quarter inch above and behind the center of the meatus. *d*, Trephine opening for temporo-sphenoidal abscess (Barker), one and one-quarter inch behind and above center of meatus. The needle should be directed at first inward, and a little downward and forward. *e*, Trephine opening for cerebellar abscess, one and one-half inch behind and one inch below the meatus. The anterior border of the trephine should be just under cover of the posterior border of the mastoid process. Such an opening is well removed from the lateral sinus, and a needle, if directed forward, inward and upward, would enter an abscess occupying the anterior portion of the lateral lobe of the cerebellum, the usual site of an abscess in this part of the brain. (After *Ballance, Jacobson and Steward.*)

will be readily drained upon the removal of the bone button. Where the dura bulges, a "groove directore" is plunged into the brain in the direction of the abscess for a distance of from two to two and one-half inches. Search should be made in different directions until the pus is located. After locating the pus, the brain tissues should be incised with a knife. The abscess cavities should be curetted and irrigated with a hot saline solution, a soft rubber

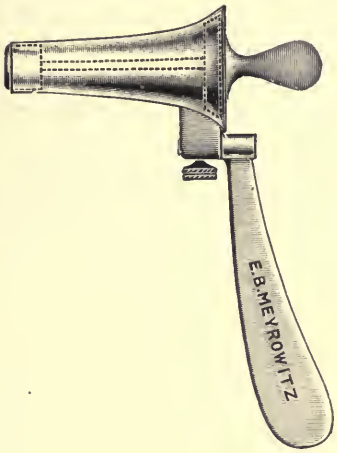

FIG. 106.—WHITING'S ENCEPHALOSCOPE.

drainage tube inserted, and the lesion allowed to heal by granulation. During the operation, precautions should be taken to retain the heat equilibrium of the body by constantly flushing the exposed brain with a hot salt solution or sublimate 1–10,000. This solution should be placed in the irrigator at a temperature of 115°, as practiced by Horsley. The salt solution also arrests capillary and arterial hemorrhage.

For a more thorough examination of the wound and abscess cavity, Whiting has designed the encephaloscope, with which the character of the abscess, whether acute or chronic, can be discovered and the wound completely explored. With the encephaloscope the wound can be easily packed without injury to the normal brain tissue.

The wound should be irrigated once daily with warm normal salt solution, and the drainage tube gradually withdrawn by shortening at each dressing, until recovery is complete. The wound may be packed with a strip of iodoform gauze, previously saturated with a solution of peroxid of hydrogen 1–4. The dressing should be changed once daily until all traces of pus from the brain cavity disappear, when the wound in the dura may be allowed to close. The post-auricular wound should now be allowed to granulate and fill as after the radical mastoid operation. The general treatment consists in the correction of any constitutional dyscrasia and a general tonic treatment. The general nervous symptoms usually pass away with a complete restoration of the patient to health. If the center for hearing has been somewhat involved, partial deafness may result. It is noticeable in some of these cases in which there is a partial deafness, that the hearing will be accentuated after a few moments' conversation with the individual.

CHAPTER XV.

DISEASES OF THE INTERNAL EAR.

Anemia of the Labyrinth.—*Etiology.*—Anemia of the labyrinth may result from simple or pernicious anemia or profuse hemorrhage from some portion of the body, neoplasms of the brain interfering with the blood supply to the ear, endocarditis, osteosclerosis, or embolism of the auditory artery.

Diagnosis.—If following a profuse hemorrhage from injury during operation, parturition or pernicious anemia, the patient complains of tinnitus, dizziness, nausea especially upon assuming a sitting position, partial loss of bone conduction and more or less deafness, the diagnosis is quickly established.

Treatment.—The treatment consists in the attention to the general condition of the patient, the administration of ferruginous tonics, strychnin, burgundy wine at dinner and favorable hygienic surroundings.

Hyperemia of the Labyrinth.—Hyperemia of the labyrinth may result from middle ear inflammation, exanthematous diseases, mumps, some intercranial disease, cessation of menstruation, disease of the heart, excessive use of alcoholic liquors, quinin, amyl nitrate, prolonged irritation from the use of the telephone receiver and vasomotor disturbances.

Symptomatology.—There is present a sensation of fullness in the ear, with ringing and roaring sensations and sometimes giddiness, nausea and vomiting. The symptoms are somewhat intensified by the horizontal position.

The auricle and auditory canal and the long process of the malleus may be hyperemic.

Diagnosis.—The diagnosis is based upon the subjective symptoms as enumerated. There is a diminution of bone conduction

and more or less deafness. The deafness and dizziness are intensified by inflation of the middle ear.

Prognosis.—Deafness is permanent as a rule, where a small exudation of blood takes place in the labyrinth, especially in the cochlea. Suppuration of the labyrinth may occur from infection, ending in complete destruction of the labyrinthine structures and sometimes in death.

Treatment.—The treatment is local depletion, pilocarpin one-sixth to one-eighth grain daily by the mouth, the administration of bromid of potassium, contraindication of all simulants and the avoidance of any sudden physical exertion.

Hemorrhage into the Labyrinth.—Following hyperemia of the labyrinth, small extravasations of blood may occur within any portion of the membranous labyrinth. In addition to the above cause, we may have a blow upon the head, fall, fracture of the skull, concussion from explosion and degeneration of the blood vessel walls.

Diagnosis.—Sudden deafness, unilateral or bilateral, with dizziness, nausea, tinnitus and a tendency to fall to the affected side following any of the above conditions recorded, is suggestive of hemorrhagic extravasations within the labyrinth.

Prognosis.—If the extravasation is very small, absorption may take place in a few weeks with restoration of the normal hearing. Should the exudation undergo fibrous degeneration, partial deafness will be permanent. Progressive deafness may continue until there is complete loss of function.

Treatment.—Iodid of potassium may be given in ten to fifteen grain doses for six to eight weeks. The iodids should be pushed to the utmost if there is a history of syphilis.

Pilocarpin in one-tenth grain doses twice daily may be given. After a few weeks, in addition to the iodid of potassium, quinin can be given in small doses to increase the flow of blood to the parts and the absorption of the exudation. In the beginning, attention is directed to the diet, free catharsis and rest in bed.

Ménière's Disease.—Ménière's disease is presumed to be an acute, serous or hemorrhagic extravasation at the nerve endings of the auditory nerve within the semicircular canal and may be due

to some vaso-motor disturbance, or beginning arteriosclerosis. The predisposing causes are syphilis, mumps, and typhoid fever.

Symptomatology.—The symptoms characteristic of Ménière's disease are sudden noises in the ears, followed by more or less deafness, pallor, nausea and vomiting. The patient may complain of dizziness and fall to the ground, falling to the affected side, if only one side is diseased. The nausea, rotary dizziness and loss of equilibrium may last for only a few minutes and may recur at longer or shorter intervals.

Diagnosis.—Sudden deafness, staggering gait, nausea and vomiting without symptoms of disease in any other organ of the body, negative bone conduction and positive Rinne, are diagnostic signs of Ménière's disease. The disease should not be confounded with epilepsy or disease of the brain.

Treatment.—Treatment rarely results in any good. Rest in bed with cold applications to the mastoid, cathartics and liquid diet, iodid of potassium and pilocarpin as in labyrinthitis may exert favorable influence. Diluted hydrobromic acid, fifteen drops three times daily, is highly recommended.

Diseases of the Auditory Nerve.—Diseases of the auditory nerve may be hyperemia, hypertrophy and atrophy of the nerve and may be secondary to inflammation and suppuration in the middle ear, meningitis, encephalitis and intercranial growths.

The pathological changes are seldom observed during the life of the individual. Where the origin of the nerve is only involved, deafness is the one symptom complained of. Where the peripheral portion of the nerve is involved, the symptoms vary but little from those enumerated in otitis interna (see Symptoms of Nervo-fibroma of the Auditory Nerve).

Atrophy of the auditory nerve does not necessarily follow from suspension of function, as observed in the optic nerve.

Neurosis of the Auditory Nerve.—Neurosis of the auditory nerve is subdivided into hyperaudition, paracusis, tinnitus aurium and hysterical deafness.

Hyperaudition.—Hyperaudition is an occasional increase of the hearing power for all sounds or for specific sounds and tones.

The affection may be the forerunner of some cerebral disease.

Cause.—The exciting cause of the affection is presumed to be cerebral hyperemia, due to excessive indulgence in alcoholic liquors.

Treatment.—The treatment is directed to the mild congestion of the brain by the enforcement of rest, mild purgatives, cold baths, static electricity and the interdiction of alcohol and tobacco. As a rule, one drop of purified tincture of gelsemium combined with ten to fifteen grains of bromid of sodium, administered every three hours, has a beneficial effect.

Paracusis[1].—Paracusis is a disease or a condition of the perceiving organs, characterized by the perverted perception of sound, due to some disease of the nerve of the middle ear. Sounds which are heard as double tones are known as paracusis diplacusis. Paracusis loci is an inability to locate directions of sounds. Sounds heard better in the midst of a loud noise are classified as paracusis Willisii. Politzer describes the increasing of hearing in a loud noise as being due to the movements of the ankylosed ossicles.

Treatment.—The treatment of paracusis is directed to the removal of the cause which is usually dry catarrh or sclerosis of the tympanic mucosa.

Hyperesthesia Acustica.—This is a condition of acoustic apparatus in which there is a painful sensation in one or both ears, produced by the perception of certain sounds, particularly noticeable in nervous or hysterical individuals, those suffering from headache, severe general disease in convalescence or in acute inflammation of the middle ear, or labyrinthitis.

Tinnitus Aurium.—Sounds vary in individuals and under varied pathological conditions. As a rule, they are classed by the individual according to the sounds most familiar to them, *i.e.*, whistling, roaring, buzzing, cracking, blowing, chirping, as that of a cricket, musical sounds, etc.

[1] Pseudokousma is a condition closely associated with paracusis and is, according to Koyle, a false perception of pitch in one or both ears for air conduction. The bone conduction remains normal. The treatment is directed to the relief of the middle ear catarrh, which is usually present.

Sounds of this character may be high or low pitched, continuous or interrupted. As to intensity, they may be so loud as to disturb sleep, oftentimes bringing about insomnia which may lead to suicide. On the other hand, the sounds may be only faintly heard at intervals and then only for a short time.

The varied changes in the weather may have a great influence upon the character and intensity of sounds, especially when the individual is suffering from a catarrhal condition involving the Eustachian tube and middle ear.

Sounds are not alone confined to one ear, but may involve both simultaneously. A great many individuals experience a slight ringing and roaring in the ear which may last only for a few moments and return after long intervals and which is hardly indicative of disease. Tinnitus aurium is not alone due to disease, but may be superinduced by such drugs as quinin, salicylic acid, calcium sulphid, etc.

As a rule, sounds are classified as intrinsic and extrinsic. By intrinsic is meant those sounds which are located within the ear. The patient may, from habit, change extrinsic sounds into intrinsic. Extrinsic sounds are those which are supposed by the individual to have their origin external to the ear.

Many sounds in the beginning of the disease are extrinsic, but the knowledge of the patient soon places the sounds within the ear. Gowers mentions a case sending a message to his next-door neighbor asking that a clock be removed, the loud striking of which annoyed him. The patient was convinced that the sound was only subjective after finding no clock in the neighborhood.

Sounds may be located in the head and become very acute under certain conditions, for instance, in *petit mal* patients often speak of the warning due to the central disturbance.

The pathology of tinnitus aurium is directly that of the disease producing the subjective symptoms. Many and varied are the diseases which may bring about some temporary or permanent alteration in the central nervous system, the auditory nerve, the labyrinth and the conducting apparatus.

Acute and chronic inflammatory changes may involve any of these

organs, bringing about the one symptom of tinnitus. Among the many causes which produce this one condition are alteration in the blood stream to the ear, anemia, intercranial aneurism, alteration in the calibre of the blood vessels of the ear, the direct influence of toxins upon the labyrinth and middle ear, osteosclerosis, and such diseases as mumps, scarlet fever, typhoid fever, malarial fever, diabetes, rheumatism, gout, etc.

Defective ventilation of the middle ear, an important factor in the cause of the disease, is due to obstruction in the nose or lessening of the calibre of the Eustachian tube from catarrhal exudation.

Suppurative inflammation of the middle ear and obstruction in the external auditory canal from foreign bodies, impacted cerumen and morbid growths, over-indulgence in alcoholic liquors, tea, coffee, drugs and tobacco are also exciting causes.

Syphilis is presumably one of the diseases productive of alteration in both the perceiving and conducting apparatus of the ear. Concussion of the brain, tumors, cerebral aneurisms and meningitis are all factors productive of tinnitus.

With so many diseases recognized as producing this one symptom, it is necessary, in diagnosis, to go deeply into the law of exclusion in ferreting out the pathology of this condition.

Treatment.—The treatment is subjective and is directed to the removal of the cause. Special treatment consists in the internal administration of one of the following bromids: connabis indica, nitroglycerine, tincture of digitalis, external vibratory massage, and freezing the mastoid with ethyl chlorid. Operative measures, that is, ligature of the external carotid, are dangerous, and may be followed by death.

Hysterical Deafness.—Hysterical deafness is a continuous or alternating want of coördination in the center for hearing, due to some functional disturbance from self-conscious domination, or to disease in some part of the nervous system in relationship to the center of hearing. In some cases of hysteria, the sensation of hearing is much more acute than in the normal individual.

Etiology.—The disease is more frequent in women than in men. Among the predisposing and exciting causes of the disease are hered-

ity, mental excitement, traumatism, pelvic disorders, environment and functional or organic diseases of the nervous system.

Pathology.—The ear symptoms are purely subjective. The tinnitus and aural syndrome may be due to vaso-motor disturbances, from excitement of the cervical sympathetic ganglion sending fibers to the labyrinth or to the carotid plexis, which supply the middle ear and Eustachian tube, or to circulatory disturbances in the centers for hearing.

A functional disturbance of the center for hearing, or the auditory nerve, may be the cause of the deafness, without any structural change.

Symptomatology.—The general symptoms of hysteria are so well known that a repetition is hardly necessary. The aural symptoms usually accompany some general symptoms of the disorder. Deafness and aural syndromes may be unilateral or bilateral, and if unilateral, migrate from one side to the other, preceding or following the general spasm.

If the disease is continuous in character, the patient may associate with the deafness, general disturbance in the throat, mouth, and oral cavities. The general manner and actions of the patient usually suggest the disease.

Diagnosis.—The general symptoms usually suggest the character of the disease. It may be somewhat difficult to conclude the presence or absence of hearing. Sudden deafness following a seizure is suggestive of functional deafness. The aural cavity should be inspected for foreign bodies or pathological change.

The disease is more often found in young women, and in consequence, arteriosclerosis of the labyrinth may be reasonably excluded. In structural change in the middle ear or labyrinth, the deafness will be permanent and confined to the diseased ear.

Successive examinations of the perceiving apparatus will usually show normal bone conduction. Brain tumors and serous meningitis may simulate hysteria, and should be considered in the diagnosis, likewise aneurisms of the internal carotid artery, and the basilar artery, in the production of subjective diseases. In aneurism, the noises are frequently objective, that is, they may be heard by the physician with an auscultation tube.

Prognosis.—The prognosis depends upon the removal of the general symptoms and the future control of the patient. Uncomplicated hysterical deafness usually responds to treatment.

Treatment.—The treatment is directed to the removal of any general causes. The local treatment is the same as that for the relief of any catarrhal condition of the middle ear, or hyperesthesia or anesthesia of the auditory terminal filaments.

Rest, tonics, and external vibratory massage are usually indicated. Any operative measures in the nose and throat for the relief of hypertrophies or stenosis are probably indicated as much for the mental effect as for the restoration of the normal contour of the nasal or oral cavity.

Inflammation of the Labyrinth (Otitis Interna).—Inflammation of the labyrinth is usually secondary to disease of the middle ear or mastoid, caries and necrosis of the temporal bone, diphtheria, scarlet fever, measles, mumps, fracture of the skull, blow upon the head, or the "sequelæ of meningitis purulenta or meningitis cerebrospinalis epidemica" (Politzer).

Symptomatology.—The patient complains of a sudden roaring sensation in one or both ears. As a rule, within twenty-four hours, the patient suddenly becomes extremely dizzy with a tendency to fall to the affected side. Vomiting is present in severe cases and may continue for several hours. The sounds are high-pitched and continuous. The patient is compelled to remain quietly in bed for from one to three weeks on account of the dizziness. No objective symptoms are present other than a slight hyperemia of the drum.

Diagnosis.—As a rule, the diagnosis is very easy. Partial or complete loss of bone conduction and hearing, high-pitched sounds on the affected side with marked disturbance of equilibrium, all indicate the site of the lesion.

Prognosis.—Where the effusion or metastatic infiltration has remained in the labyrinth for any great length of time without any apparent absorption as manifested by a change for the better, the prognosis is usually bad, deafness remaining. The prognosis is more favorable in primary than in the secondary form of the disease.

Treatment.—The treatment consists in rest in bed, local depletion, leeches to the tragus, back of the auricle and mastoid, application of the Leiter coil or ice bags to the mastoid, morphia internally and liquid diet. With no relief of deafness, after two weeks, the internal administration of large doses of iodid of sodium is indicated. Elimination should be encouraged by daily hot baths.

Panotitis, or Inflammation of both the Middle and Internal Ear.—Panotitis, or inflammation of both the middle and internal ear, occurs more often in children than adults and is accompanied with marked constitutional symptoms, due to acute, severe, infectious diseases, such as scarlet fever, diphtheria, measles, etc. Necrosis of the thin wall separating the labyrinth from the middle ear may occur, causing total deafness.

Symptomatology.—The disease is usually ushered in with a high fever, eclamptic seizures, delirium and sometimes loss of consciousness, which varies from a few hours to a number of days. The patient may complain of tinnitus, vertigo, staggering gait, purulent discharge from the middle ear and complete deafness. Inflammation of the facial nerve or facial paralysis may result from the extension of infection through the osseous wall of the Fallopian canal. In perineuritis, the patient may complain of pain along the course of the facial nerve for a number of weeks after the acute symptoms of the disease have passed away.

Treatment.—The treatment consists in rest in bed, the hypodermic administration of pilocarpin, free purgation and iodid of potassium. The middle ear should be cleansed twice daily by irrigating with a hot solution of lysol, one-half drachm to a pint of water, followed by the instillation of a mild astringent.

Syphilis of the Labyrinth.—Syphilis of the labyrinth may be congenital or acquired. If present in young children, congenital syphilis involves both ears as a rule and usually produces deaf-mutism. Congenital syphilis of the labyrinth may manifest itself either in infancy or adult life.

Acquired syphilis of the labyrinth is normally a tertiary lesion though involvement of the labyrinth may take place during the secondary period of the disease.

Labyrinthitis may be primary or secondary to syphilis of the middle ear.

Pathology.—The disease is due to a periostitis with infiltration of the round cells into the membranous and osseous structure and change of the endolymph into a sero-bloody fluid, according to Barrataux.

Caries of bony tissue may take place from suppuration subsequently involving the middle ear.

Following the exudation from the inflammation, a general sclerosis may occur, completely destroying the function of the internal ear.

Symptomatology.—The disease begins with a continuous low ringing and roaring in the ears, which become high-pitched with the progress of the disease. The disease is sudden in its onset, progresses rapidly and ends in partial or complete deafness. There may be slight vertigo, differing, however, from the profound vertigo of Ménière's disease. There is an absence of inflammatory symptoms other than an intermittent pain deep in the ear.

Deafness is rapidly progressive, both by air and bone. Weber's test is more distinct in the ear least affected. Low tones are first lost, followed by the loss of high tones.

Diagnosis.—The disease should be differentiated from Ménière's disease, suppuration of the labyrinth and tumor of the brain.

Absence of peripheral symptoms of brain disease, history of syphilis, rapid onset of the disease, continued and progressive deafness and loss of bone and air conduction are diagnostic signs of the disease.

Prognosis.—Deafness is usually progressive and frequently ends in total deafness, provided the most profound antisyphilitic treatment is not quickly and systematically instigated.

Treatment.—The general treatment consists in the daily inunction of mercury for ten days and the internal administration of iodid of potassium, followed by the mixed treatment. Pilocarpin in one-tenth grain dose to the adult with corresponding decrease of the dose for children should be given hypodermatically for ten days. A blister in the form of cantharidal collodion should be applied to the post-auricular region and should be repeated after four or five days.

Irrigation of the auditory canal twice daily with a hot normal salt solution is highly beneficial in stimulating lymphoangiectasis of the middle ear and labyrinth.

In addition to antisyphilitic treatment, tonics, attention to personal hygiene and out-door exercise should be prescribed. The disease may be somewhat controlled and often perceptibly improved after a week to ten days' treatment. The length of time necessary for constitutional treatment varies in no wise from that of syphilis in any other portion of the body.

Otosclerosis of the Inner Ear or Spongification of the Bony Capsule of the Labyrinth.—This is a condition of fixation of the stirrup by a rarefying ostitis of the labyrinth and middle ear, especially about the oval window, occurring in individuals over eighteen years of age and reaching a climax about the patient's twenty-eighth or thirtieth year.

Etiology.—Heredity is presumed to play an important part in the causation of the disease. Advisedly speaking, other causes are inflammation of the periosteum of the middle ear, syphilitic, gouty, rheumatic and, as suggested by Katz, neuroparalytic or trophoneurotic diathesis.

Pathology.—The pathology of otosclerosis is still a subject of investigation. Siebenmann's theory of spongification is that the disease is one due to faulty fetal development and that the bone tissue of the labyrinth takes on a process of progressive spongification instead of changing into smooth, compact bone (see Fig. 107).

Katz reasons that the disease is purely one of an inflammatory nature, that it is periostitis of the middle ear and subsequent involvement of the labyrinth.

Politzer believes the disease to be a circumscribed primary inflammation of the bony labyrinth about the oval window with the formation of new bone substance and complete ankylosis of the stapes, due to the action of osteoblasts. He found bone corpuscles to be more numerous than in normal bone. The bony spaces were greatly dilated and filled with connective tissue, rich in cells and enclosing large and small blood vessels and in some cases giant cells, osteoblasts and osteoclasts.

Symptomatology.—The patient complains of progressive deafness, a constant ringing and roaring in the ears, usually high-pitched, and sometimes deep pains in the ear alternating with a sensation of constriction about the head. A slight dizziness may be present at intervals.

Diagnosis.—The Eustachian tube is usually found open and the drum membrane resembles the normal. There is a loss of hear-

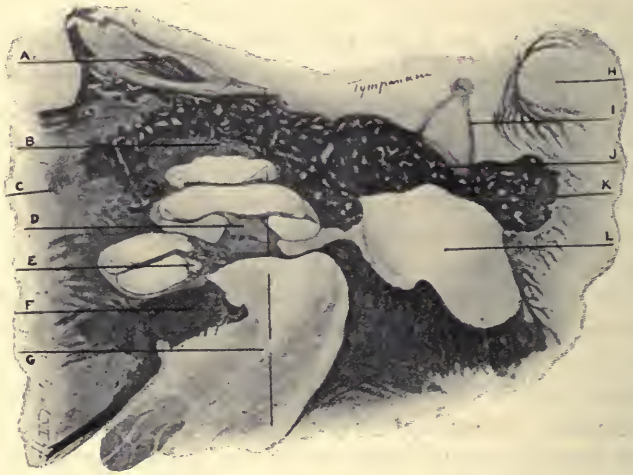

FIG. 107.—HORIZONTAL SECTION THROUGH THE LABYRINTH IN THE REGION OF THE STAPES AND UPPER PORTION OF THE COCHLEA.

Showing bony fixation of the stapes and hyperplasia of the capsule of the labyrinth. *A*, Tensor tympani; *B*, capsule of cochlea; *C*, normal bone; *D*, central axis of cochlea; *E*, ganglionic canal; *F*, hyperplasia of bone; *G*, acusticus; *H*, facial nerve; *I*, stapes (ankylosed); *J*, stapes, foot plate (ankylosed); *K*, hyperplastic bone; *L*, vestibule. (After *Siebenmann*. By courtesy of *Dr. Henry J. Hartz.*)

ing for low tones, a negative Rinne and negative Gelle. There is little or no improvement upon inflation of the middle ear.

Treatment.—The treatment is essentially constitutional and is as recommended by Siebenmann, confined particularly to pilocarpin one-one-hundredth to one-twentieth of a grain, three times daily.

The tinnitus may sometimes be relieved by vibratory massage of the meatus. Catarrhal conditions of the nose and naso-pharynx, which might complicate the disease, should be treated. Sea bathing, outdoor exercise and general hygienic measures should be advised. The symptoms are usually aggravated by physical exhaustion. Presuming the disease to be an inheritance, and the arteriosclerosis active, the treatment is somewhat prophylactic, and according to Körner, we may accomplish something by advising the person who is suffering from arteriosclerosis, not to marry.

Paresis and Paralysis of the Auditory Nerve.—Paresis and paralysis of the auditory nerve may be due to hemorrhagic extravasations, necrosis of the temporal bone, trauma, angioneurosis, rheumatism, hysteria, tumors of the brain, measles, syphilis, locomotor ataxia, mumps, exanthematous diseases and meningitis.

Symptomatology.—The symptoms vary somewhat according to the portion of the nerve involved. If the cochlear portion of the nerve is diseased, there is a loss of hearing and bone conduction. If the portion of the nerve going to the semicircular canal is involved, there is nausea, staggering gait and a tendency to fall to the affected side. During the course of the disease, the hearing varies somewhat in acuteness according to the variations in the temperament of the patient and surroundings. If there is present also a facial paralysis, the site of the lesion is usually within the internal auditory canal. The loss of hearing in tabes may, according to Gowers, be sudden or gradual in onset, transient or lasting.

Diagnosis.—It is very difficult to differentiate the disease from interlabyrinthine diseases. Partial loss of function and sudden restoration of the hearing frequently enables a differentiation of the disease from diseases of the labyrinth, which are slow to recover. The tuning fork will be heard on the opposite side in the Weber test. There is usually deafness for high-pitched sounds, as shown by the Galton whistle. Rinne is positive and shortened in partial paralysis. Bone and air conduction is entirely lost in paralysis of the nerve.

Treatment.—The treatment for paresis or paralysis of the auditory nerves depends upon the duration and cause of the disease. The

general treatment consists in the administration of alteratives, rest in bed, hot foot baths, saline purgative or the application of galvanic current by means of the ear electrodes with negative pole to the ear, continued for six to eight minutes as strong as can be conveniently borne.

Arteriosclerosis of the Labyrinth.—Arteriosclerosis of the labyrinth may be local, or a part of a general sclerosis of the arterial and cellular structure of the body.

Etiology.—The etiology of arteriosclerosis of the labyrinth is the same as for that in any other part of the body, and may be syphilis, laborious occupation, alcoholism, lead poisoning, infectious fevers, auto-intoxication, vaso-motor disease and heredity.

Syphilis is probably the most important factor in the etiology of the disease in middle life.

The disease may be unilateral or bilateral, and is observed early and late in life.

Pathology.—The affection probably begins as a structural change in the vaso-vasorum, and is fibrous in character. The labyrinthine artery is the single artery of the labyrinth and as soon as the nutrition in the artery wall is disturbed, connective tissue degeneration takes place in the media. Fatty degeneration soon follows in the intima, with the formation of deposits of calcareous salts. The vessel wall may sometimes become narrowed, or even obliterated.

As soon as the nutrition of the basilar membrane and organ of Corti is partially or completely cut off, there is atrophy of the sensory auditory cells and connective tissue proliferation of all the structures. The same change may be observed in the nerve endings of the vestibulæ and semicircular canals.

A study of the schematic drawings in figure 108, taken from Alexander and Escat, will give the reader a clear conception of the change in the cochlea. Figure A, represents the normal organ of Corti. In Figure B, there is shown a complete atrophy of the cells of Claudius and Deiter, and the epithelial cells of Reissner's membrane.

The cells of the organ of Corti have undergone connective tissue proliferation, with closure of the tunnel of Corti and disappearance of the vas spirale.

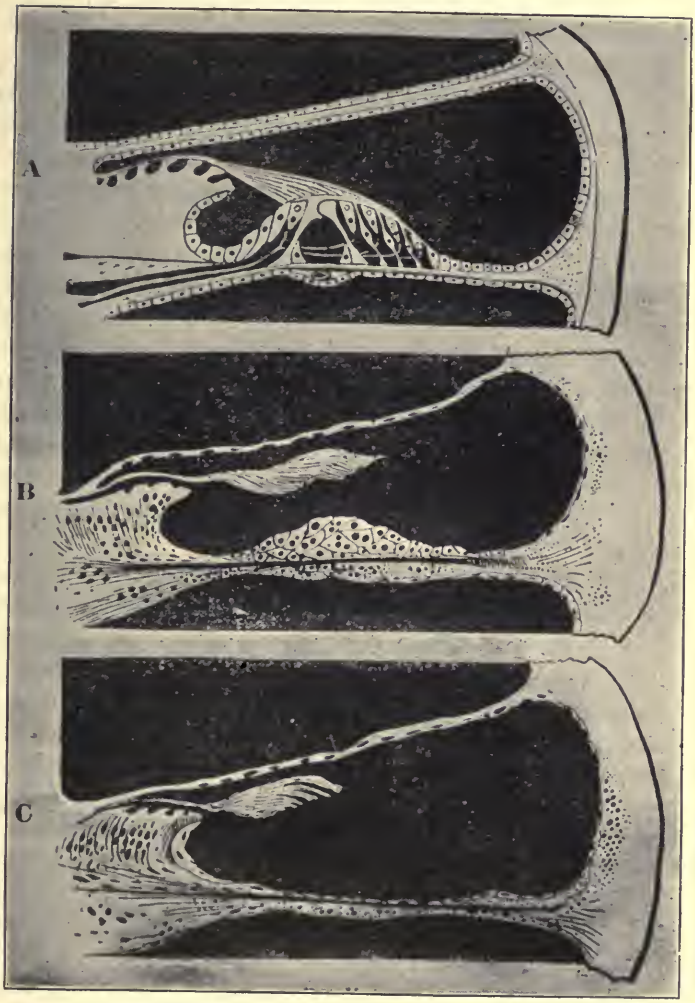

FIG. 108.

In Figure C, there is represented the last stage of the destructive process, as described by Alexander, that is, absorption of the nerve elements and connective tissue deposits.

The change in the brain structures from arteriosclerosis may vary according to the amount of nutrition carried to the parts. In endarteritis obliterans in the vessels to the center of hearing and equilibration, there is, on account of the slow change in the artery wall, degeneration and atrophy of the brain cells. The same morphological change takes place when the blood supply is partially destroyed.

Symptomatology.—The symptoms of arteriosclerosis are both general and local. The general symptoms of arteriosclerosis are increased arterial tension, increased tortuosity and prominence of the arteries of the temple, hypertrophy of the heart, and if the last is present, there is generally a lowered vitality of the individual, a sensation of age, and tiring, as from overwork, followed by an appearance of premature aging. Analysis of the urine usually shows increase of the urates and long, thin hyaline casts, undergoing granular degeneration.

The ear symptoms which should direct our attention to a local or general circulatory disturbance are unilateral or bilateral tinnitus, slight and progressive deafness, loss of air and bone conduction, dizziness sometimes early in the disease, and in the later stages of the disease, sometimes hallucinations of hearing. The ear symptoms necessarily vary according to the extent of the sclerosis.

Diagnosis.—The above symptoms, both general and local, should always direct the physician's attention to the possibility of arteriosclerosis. The early diagnostic symptoms are tinnitus, vertigo, nutritive change in the membrana tympani, that is, the presence of an arcus senilis, and slight deafness, unilateral or bilateral. If the general symptoms, as numerated above, are also present, the diagnosis is usually complete.

The location of the deafness, that is whether in the nuclear or labyrinthine endings of the nerve, may, according to Gradenigo, be shown by the tuning forks. A diminution in bone conduction over the normal, for highest tones, is indicative of a labyrinthine deafness.

In central deafness, there is a pronounced loss of perception for high tones as well as for low tones.

The disease should not be confounded with Ménière's disease, hyperemia of the auditory nerve, hysterical deafness, hemorrhagic extravasation in the labyrinth from a fall or blow upon the head, or nerve deafness from toxic absorption.

Prognosis.—The prognosis is usually very grave as far as the restoration of hearing or complete cure of the tinnitus is concerned. By general treatment, the symptoms may frequently be relieved, and often brought to a standstill.

Treatment.—The treatment of arteriosclerosis of the ear is both general and local, depending somewhat upon the exciting cause. Those cases with hereditary influences as predisposing factors do not respond to treatment as do those with syphilis or acquired causes. However, in both conditions, the iodid of potassium, in from two to five grains, four or five times daily for long periods of time, is indicated.

CHAPTER XVI.

INJURIES OF THE MASTOID PROCESS AND FRACTURES OF THE TEMPORAL BONE.

Injuries of the Mastoid Process.—Injuries of this character are usually due to a fall, blow upon the mastoid, gunshot wound or stab. Contiguous parts may or may not be involved. In times of war, army surgeons may be called upon to treat injuries of this region.

According to Makin ("Surgical Experiences in South Africa") wounds in this region from gunshot usually produce complete paralysis of the seventh nerve. In a number of cases reported by Makin, there was also paralysis of the auditory nerve and rupture of the drum.

Stab wounds in the mastoid may involve the cells of the antrum. The point of the knife may break off and remain embedded as in the case of Ostmann, in which the point of the knife remained twelve years without producing any irritation.

Wounds of the mastoid, provided there is not a complete crushing of the mastoid, heal without other treatment than irrigation and antiseptic dressing. If the tip of the mastoid is crushed it may be necessary to incise the parts, extract the small particles of bone and drain with a strip of gauze.

Fracture of the Temporal Bone.—Fracture of the temporal bone frequently accompanies fracture of the occipital bone and is due to a fall upon the forehead, blow upon the side of the head or occiput and penetrating wounds.

The line of least resistance of the petrous portion of the temporal bone is, "from the jugular foramen to the tegmen tympani et antri," and in consequence, it is at this point that fracture more often occurs. The line of fracture must vary according to the direction of the blow and the nearest fossa to the impact.

Fractures of the temporal bone may be simple or compound. In

compound fractures, we have a rupture of the mucous membrane of the dura, hemorrhage into the middle ear, rupture of the drum and escape of the cerebro-spinal fluid.

Blood serum differs from cerebro-spinal fluid in this respect: blood serum dries quickly and is highly albuminous while cerebro-spinal fluid is of low specific gravity, dries slowly, contains chlorid of sodium and frequently sugar.

The hemorrhage from the ear in compound fracture of the base of the skull is very profuse in some cases. The patient may become exsanguinated. The flow of the cerebro-spinal fluid may continue for a number of days.

A serous discharge with fracture and rupture of the drum may have its origin in the middle ear and mastoid cells. Blood may escape by way of the Eustachian tube.

Paralysis of the seventh nerve may or may not occur. The labyrinth frequently escapes injury but, should the labyrinth be injured, deafness is usually permanent.

Prognosis.—A guarded prognosis should always be given. Cases with severe ear complications frequently recover. Late unconsciousness and high temperature or a continued subnormal temperature without reaction are bad prognostic signs. The nausea and dizziness pass away in a short time in favorable cases.

Treatment.—In addition to the general treatment as prescribed by the surgeon, the ear should be cleansed with a warm solution of lysol or diluted alcohol. Irrigation should be sparingly indulged in on account of the liability of carrying infection from the auditory canal into the meningeal cavity. The ear should be tamponed lightly with antiseptic gauze which should be frequently changed. The nose and throat should be cleansed twice daily with Dobell's solution to prevent, as far as possible, infection from reaching the middle ear through the Eustachian tube.

CHAPTER XVII.

MALFORMATION OF THE HEARING APPARATUS AND DEAF-MUTISM.

Malformation of the Hearing Apparatus.—A reference to the embryology of the ear will demonstrate how it is possible for the auricle to be deformed from want of development in one or all of the primary germinal cells. The meatus and auricle may be absent, imperfectly developed or abnormal in size and position. A blind canal opening on the external or inner portion of the helix is sometimes observed, known as a *fistula auris congenital.* If the auditory canal is closed, deafness results. Malformations of the Eustachian tube, middle and internal ear frequently accompany like conditions of the external ear. The mastoid antrum, mastoid cells or the tympanic membrane may be absent or partially developed. Grunert mentions a case of Kauffman's in which the hammer and anvil were developed as a single bone. The internal ear may be absent or partially deformed while the auditory nerve may be atrophied or undeveloped.

Treatment.—If atresia of the canal exists and perception of sounds can be heard through bone or through the Eustachian tube, as in the Bing test, operative measures for opening the canal may be indicated.

Plastic operation or resection of the cartilage of the pinna may be undertaken for the correction of any abnormality in size or position. In the great majority of cases, operative measures are either contra-indicated or the patient refuses to submit to any effort at correction.

Deaf-mutism.—Deaf-mutism is a condition of congenital or acquired loss of hearing and power of speech.

Etiology.—Deaf-mutism may be inherited or acquired. The exact status of heredity as an etiological factor is imperfectly under-

stood. The marriage of first cousins is thought to predispose to the disease.

Hartman reports a case in which a deaf mute was born to parents whose grandparents and great-grandparents were closely related.

Two or more deaf mutes may be born to parents in whom there is no history of the disease. Deaf mutes seldom beget deaf-mute children. The intermarriage of deaf mutes should be prevented, as far as possible.

The disease may result from faulty embryological development of the ear, diseases in early life, cerebrospinal meningitis, mumps, primary inflammation of the internal ear and injury.

The disease is more frequent in Switzerland that in any other country and occurs more often in boys than in girls. It is presumed that the high altitude of Switzerland predisposes to the disease.

Pathology.—There is an arrested development in the auditory nerve and its termination in the labyrinth, from the patient having suffered, not infrequently, an attack of intra-uterine meningitis, syphilis or tuberculosis.

Among the pathological changes noted in the ear of deaf mutes at post-mortem, according to Politzer, Mygind, Moos, Steinrugge, Bezold and others, are atresia of the external auditory canal, absence of the middle ear, osseous degeneration around the oval window, faulty development of the internal ear, absence of the nerve in the lamina spiralis and various changes within the osseous structures of the internal ear.

Prognosis.—According to the observations of Bezold, one-third of all the children confined in deaf-mute institutions have a slight degree of hearing. If this could be detected by the otologist in charge, and all institutes should have a visiting otologist of repute, the child might be taught to speak and hear. If there is no hearing, the chances are the child cannot be taught to speak. However, many children congenitally deaf, do learn to speak.

According to Bezold, the greater proportion of deaf mutes become so about the second year of life.

Unless children who become deaf mutes about the eighth year

of life are constantly drilled in speech, they may forget that which they have already learned and depend upon the sign language.

Diagnosis.—Unfortunately, it often occurs that children suspected of deaf-mutism are neglected, or the pride of the parents prevents a disclosure of the disease. It is extremely difficult to tell in a young child, who is presumed to be totally deaf, whether or not any hearing exists. Only by the most careful test of the hearing and observation of the countenance of the child during the test, can one positively disclose the presence of hearing. In children old enough to possess some intelligence, examination can be conducted with a greater degree of precision. If the faculty of speech has been forgotten, a quicker response to tests of hearing will be elicited than in those without any previous knowledge of speech.

Treatment.—With the advance of institutional work and the work of the otologist in such schools, a great deal has been accomplished in purely a surgical way in the relief of many deaf mutes with a remnant of hearing, especially in those with adenoid vegetations and enlarged tonsils. In those with congenital deafness, the trouble may be due to the accumulation in the Eustachian tube and middle ear, adhesions, etc. Local treatment has accomplished a very great change in the quality of hearing.

Politzer reports the case of Jacquemart, who brought a cure of a deaf mute in whom there was a retraction and cloudiness of both tympanic membranes by the inflation by the catheter of the Eustachian tube and middle ear. The majority of children should be sent to institutions for the training of deaf-mutism where systematic exercise of the acoustic nerve may be had and instructions given in expressing thoughts by the lips, sign language and writing.

Simulated Deafness or Malingering.—It is not infrequent that malingering cases come under the observation of physicians connected with great corporations, with the army or the United States Pension Department.

The ear should first be carefully examined for impacted cerumen, catarrhal inflammation of the middle ear, perforation of the drum, syphilis and diseases of the middle ear.

Hummel has devised a scheme for detecting simulated one-sided

deafness. He has a speaking tube fitted tightly into each ear. Then two persons with similar voices talk at the same time. They may use the same sentence, a slightly different sentence or the word may be entirely different. The one-sided deaf repeat correctly what one person says while the simulator will be confused.

In suspected malingering, the eyes should be carefully bandaged so that the relative position of the examiner cannot be observed.

When the tuning fork is placed upon the vertex, the sound will be heard in both ears and the patient may so express himself. The sounds will be intensified if both ears are stopped up. If the ear presumably deaf is closed, the patient may say he cannot detect the sound, whereas, the sound is intensified on that side.

Voltolini recommends stopping the affected ear with a perforated cork, the sound ear being closed at the same time.

Significance of Ear Disease in Life Insurance Examinations.—In examination of ears of individuals, the source of any discharge from the ears should be carefully investigated. A watery discharge from the ear may follow from eczema and is not of sufficient gravity to impair the risk. The examiner should remember that chronic myringitis may sometimes give rise to an offensive discharge and independent of any middle ear complication. A disease of this character is easily relieved, and upon its relief, the risk is not impaired.

Perforations of the drum are suggestive of trauma or acute exudative inflammation of the middle ear. A perforation of the drum may be congenital and the drum be entirely absent as shown by Kauffman. The external ear and auditory canal may be absent or deformed, in no wise affecting the life of the patient. Deformity may be observed in patients of a tubercular diathesis. Where the perforation is of long standing and there has been an absence of a purulent discharge from the ear dating back a number of years, the risk is only slightly impaired.

A history of chronic discharge and radical mastoid operation for its relief with a complete cessation of the discharge covering a period of one year does not impair the risk.

If there is a history of recurrent attacks of discharge from the ear, the hazard is considerable. An applicant with an acute or chronic

discharge from the ear is entirely hazardous. Deafness from catarrh or paralysis of the auditory nerve, independent of a history of syphilis, is a good risk. A patient with a history of Ménière's disease is a hazard and should have special rating or be rejected.

Tinnitus aurium is a subjective symptom and in many cases is of no consequence. It may indicate epilepsy, arterosclerosis or carotid or basilar aneurism. Osseous tumors in the canal are not dangerous, though special rating or rejection is necessary. Tumors of the ear make a risk hazardous.

CHAPTER XVIII.

DISEASES OF THE NOSE.

Acute Rhinitis.—Acute rhinitis is an acute catarrhal inflammation of the mucous membrane of the nasal fossæ, otherwise known as a "cold in the head."

Etiology.—The causes of acute rhinitis are both predisposing and exciting. Among the many predisposing causes are uric acid diathesis, inherited or acquired dyscrasia, occupation, unsanitary surroundings, woolen underclothing, nervous exhaustion, malformation of the septum and adenoids. Chronic inflammation of the mucous membrane, polypi and poor sleeping car ventilation are especially predisposing causes of the disease. Iodid of potassium, internally, produces a discharge from the nose, resembling symptoms of coryza.

Among the many exciting causes are the sudden and prolonged exposure of the body to draughts, damp or cold weather, after violent exercise or Turkish bath, exposure to irritating gases, extension from a like condition of the pharynx or post-nares and, as advocated by many, the presence of pathogenic microörganisms. The disease is probably infectious.

Pathology.—The pathology of acute rhinitis is essentially the same as that characterizing acute inflammation of any other mucous membrane. There is a paralysis of the vaso-constrictor fibers of the capillaries or an irritation of the dilator fibers, with swelling of the venous capillaries and lymph vessels, retention of glandular contents, which is followed by a reaction and extravasation of leucocytes, mucus, serum and lymph, with broken-down epithelium which is hastened by the previous distension of the cells. The discharge gradually changes from a serous or watery character to a thick, viscid secretion and in the last stage it becomes muco-purulent. If the

sinuses are involved from extension of inflammation, the mucopurulent character of the secretion may continue for a number of days after the nasal secretion has stopped. The pathology varies considerably when abortive measures are employed. The blood vessels gradually regain their natural tonicity after five to ten days. Absorption of the exudation within the intercellular spaces takes place and a return to the normal ensues.

Symptomatology.—The disease may be preceded by a chill or chilly sensation, lassitude, indigestion and loss of appetite. The swelling of the mucous membrane produces sneezing and difficult breathing. One or both sides of the nose may be occluded. The swelling frequently shifts from one side to the other, due to gravitation of blood.

In extension to the frontal sinuses, there will be frontal headache, mental dullness and otophonia. The Eustachian tube may be involved at the same time, especially in those cases suffering from a chronic naso-pharyngitis, producing a fullness in the region of the ostium tuba and a slight deafness. There may be a temporary loss of taste and smell. There is little or no discharge from the nose in the early stage of the disease. The patient frequently attempts, however, to dislodge a supposed accumulation of secretion by blowing the nose. The orifices of the nose may become very red, excoriated and tender to the touch during the stage of exudation. The ocular and palpebral conjunctiva may become red and the lids slightly swollen. In the second stage, or stage of exudation, a thick whitish secretion is present, which is with difficulty blown from the nose. A profuse quantity of thick, yellowish, stringy mucus is discharged from the nose during the third stage of the disease. There is a like secretion in the vault of the pharynx, especially upon awakening. The patient may complain of a slight cough, dryness of throat and mouth breathing at night. Eczematoid dermatitis is frequently associated with the disease and is often due to uric acid, a primary cause of the continued inflammation of the mucous membrane.

Diagnosis.—With the enumeration of the foregoing symptoms, the diagnosis of acute rhinitis is comparatively easy. Inspection of the mucous membrane is not always necessary to a correct diagnosis.

Prognosis.—In uncomplicated cases, the disease runs its course in from a week to ten days, ending in complete recovery or in an accentuation of an already existing chronic nasal catarrh.

Treatment.—The treatment resolves into curative and prophylactic. The curative treatment consists in the application of those agencies indicated for aborting the attack and the relief of the engorged mucous membrane. If seen in the conception of the trouble, the local application every two hours of adrenalin chlorid to the mucous membrane, with the internal administration of suprarenal gland, five grains every three hours, and ten grains of Dover's powders at bed time, with hot foot bath, may, if not entirely aborting the attack, so mitigate it that subsequent treatment is made comparatively simple. A mild purge is usually indicated in the beginning of the disease. Large quantities of distilled water or Apollinaris water should be consumed for the relief of the uric acid condition, which is frequently present. When the patient can be confined to the house, a turkish bath, given once a day, restores normal equilibrium and therefore is a great curative agent. This measure is seldom in the reach of the ordinary patient, and in consequence is of little practical value.

The following is highly recommended:

℞	Ext. belladonnæ,	.008 gm. (gr. $\frac{1}{8}$)
	Heroin,	.003 gm. (gr. $\frac{1}{20}$)
	Camphoræ,	.03 gm. (gr. ss)
	Quininæ,	.06 gm. (gr. j)
	Cascarin,	.016 gm. (gr. $\frac{1}{4}$)

Signa. One capsule every hour for four or five doses, and afterward one capsule every three hours.

Two to four per cent. solution of cocain relieves the engorged condition of the blood vessels much better than adrenalin and aids in restoring the weakened walls. A prescription calling for cocain should never be given a patient. If it is thought advisable to give a solution of cocain to the patient for home treatment, the physician himself should supply the patient with the solution. The following may be given for home treatment:

℞	Cocain hydroch.,	.24 gm. (gr. iv)
	Ext. hamamelis,	8.00 c.c. (℥ ii)
	Sat. sol. acid boracici, q. s. ad.	30.00 c.c. (℥ i)
M.		

Signa. To be snuffed into the nose from a saturated cotton-tipped probe every two hours.

During the second and third stages, the office treatment consists in first spraying the nose with a warm, one per cent. solution of cocain. After the mucous membrane has become depleted and shrunken, the nose, naso-pharynx and pharynx should be thoroughly cleansed by spraying with a warm, antiseptic, alkaline solution. Following the cleansing of the nose, a solution of sulphate of zinc, two grains to the ounce, or a solution of nitrate of silver, one-half grain to the ounce, should be sprayed into the nose and naso-pharyngeal spaces. The mucous membrane should then be thoroughly sprayed with a two per cent. solution of campho-menthol in albolene or acetoform inhalent.

In addition to the constitutional treatment, a warm alkaline and antiseptic solution should be used for home treatment, as a spray or douche before each meal.

The patient may go out of doors provided the weather is not damp. A general tonic is frequently indicated. Enlarged glands at the angle of the jaws may accompany and follow an attack of acute rhinitis.

The prophylactic treatment consists in the careful correction of any constitutional dyscrasia or gastro-intestinal disorder. Any chronic nasal catarrh, which is frequently present, should receive proper attention, personal hygiene should be insisted upon, cold tub baths upon arising or cold sponge baths are especially efficacious in stimulating the mucous membranes of the body and rendering them resistant to irritants. Nasal obstructions, post-nasal adenoids and enlarged tonsils or small tonsils containing cheesy deposits should be removed.

Simple Chronic Rhinitis.—Simple chronic rhinitis is a chronic inflammation of the entire structure of the mucous membrane of the

nose resulting directly from successive attacks of acute inflammation of the mucosa.

Etiology.—The disease is more often produced by successive attacks of acute rhinitis. A lowering of the vitality of the mucous membrane of the nose may result from age, occupation, general disease, uric acid diathesis and exposure to unhygienic surroundings.

Pathology.—The inflammation involves the entire structure of the mucous membrane. The mucous membrane proper becomes inflamed and thickened. There is an increase of connective tissue elements and frequently a lessened blood supply with dilation of blood vessel walls. There is an abundance of mucous secretion which is found mixed with desquamative epithelial cells and leucocytes. The disease is essentially one of adult life.

Symptomatology.—The patient complains of a susceptibility to catch cold and more or less stenosis of the nose with a hypersecretion of mucus. The nasal mucosa may become engorged from the slightest irritation, causing sneezing and prolific secretion of mucus. Impetigo and eczematoid dermatitis frequently accompany the disease. According to Kiesselbach, chronic rhinitis is one of the frequent causes of eczema of the nares.

Diagnosis.—Chronic nasal catarrh is observed in adult life. The mucous membrane over the turbinated bodies appears pale and somewhat thickened. A thick, grayish, muco-purulent exudation is observed along the floor of the nose. A chronic naso-pharyngitis is usually present. The patient's voice becomes husky upon prolonged use.

Hypertrophic nasal catarrh is differentiated from chronic nasal catarrh by the thickened, reddened and boggy condition of the lower turbinate.

Treatment.—The general treatment is directed, as far as possible, to the correction of any of the enumerated predisposing causes of the disease, thus enabling the vaso-motor system to regain its normal equilibrium. Some alkaline and antiseptic solution is recommended for thoroughly cleansing the nose of secretions. The patient should be given Dobell's solution with the instructions to use twice daily in Burmingham douche or a spray, preferably before meals.

The office treatment consists in applying Dobell's solution as a cleansing fluid once daily, followed by application of some astringent in varied strength as the symptoms seem to indicate. The following formulæ may be used:

℞	Zinci sulph.,	.06 gm. (gr. j)
	Glycerini,	1.00 c.c. (gtt. xv)
	Aquæ destill.,	30.00 c.c. (℥ j)
℞	Zinci phenolsulphonate,	.06 gm. (gr. i)
	Glycerini,	1.00 c.c. (gtt. xv)
	Aquæ destill.,	30.00 c.c. (℥ j)

This is followed by spray of two per cent. campho-menthol in albolene. Massage is highly recommended by Braun as a stimulant to the mucous membrane and is especially efficacious. This is again followed by an albolene spray. Should the turbinated bodies fail to react to the treatment, surgical measures must be instituted (see Turbinotomy).

For the reduction of anterior hypertrophies in chronic nasal catarrh, there is no better method than the galvano-cautery. In reduction by this method, the nasal cavity of one side should be anesthetized with a spray of a four per cent. solution of cocain. Following the shrinkage of the turbinate, a four per cent. solution of cocain should be applied with a cotton-tipped probe along the line of intended cauterization. After two or three minutes' delay, the nasal mucosa is completely anesthetized and the nasal cavity and post-nasal space cleansed of all debris with an alkaline, antiseptic spray.

The cautery is tested and graduated to a cherry red. With the nose speculum in position, the point of the cautery is carried to the site of the hypertrophy and the current turned on. At the beginning of the burning, the point is pressed into the mucous membrane and drawn gently forward, making an incision on a line parallel with the long axis of the turbinate. The depth of the incision varies. If possible, the periosteum of the bone should not be destroyed. A second application should be made a week later rather than over-cauterization at the first application. A slough is formed at the line of cauterization, which may be blown from the nose after a few days.

As a rule, healing is very rapid and shrinkage of hypertrophic tissue is in proportion to the amount of tissue destroyed.

Should the periosteum be damaged, more or less severe pain results, which may continue for two or three days. Mild inflammatory reaction may also result, the patient complaining of symptoms of acute coryza. Cauterization may excite a case of latent grip into sudden activity.

The nasal cavity should be cleansed three or four times daily with Dobell's solution after cauterization, until the wound is completely healed. Infection is always a possibility from cauterization and may extend to the sinuses or middle ear.

Due care should be observed against injuring the septum in applying the cautery to the lower turbiate.

In the absence of the cautery, chromic acid fused upon a probe may be used as a substitute. The pain from chromic acid cauterization is frequently very great.

Posterior hypertrophies should be removed with a cold snare or scissors. Hypertrophies of the mucosa of the middle turbinate should also be removed with a snare. Following cleansing, the nasal cavity should be dusted with equal parts of aristol and stearate of zinc.

Hypertrophic Rhinitis.—Hypertrophic rhinitis is a chronic inflammation of the mucosa of the nasal cavity, especially of the lower turbinated bodies, producing more or less stoppage of the nose.

Etiology.—The disease may occur at any age. The cause of hypertrophic rhinitis is usually successive attacks of acute coryza in which there has been an incomplete return to the normal. Any local or constitutional irritation, sufficient to keep the connective tissue of the submucosa distended for any length of time, will bring about the observed over-growth of tissue. Thus, digestive disturbances, climatic conditions, intemperance, sexual excesses, malformation of the septum, chronic rhinitis, catarrhal or purulent sinusitis and constitutional dyscrasias are causative factors.

Pathology.—The entire mucous membrane becomes thickened and swollen from infiltration and increase of connective tissue elements. The blood supply is increased to the parts and the cavern-

ous tissue of the lower turbinates becomes distended from the venous stasis, which is constantly present in a greater or less degree. The hypertrophic condition frequently extends to the lachrymal duct, producing chronic conjunctivitis and epiphora. The mucous membrane of the Eustachian tube is frequently involved, producing stenosis of the tube and middle ear catarrh. The bony structures of the lower and middle turbinates may also become hypertrophied from the increase of osteoblasts, due to the cause producing the change in the mucous membrane. The racemose glands are increased in number from which thick mucus and watery elements are constantly poured out upon the surface, producing stringy mucus and thick crusts from evaporation of watery constituents.

The hypertrophic change may be confined to the anterior or posterior portion or the whole of the lower turbinated body. A prolonged hypertrophy may change into a hyperplastic or sclerotic condition.

Symptomatology.—The prominent subjective symptoms are stoppage of one or both sides of the nose, sneezing, constant blowing of the nose, loss of resonance of the voice and profuse secretion of sero-mucus. The watery constituents often evaporate and leave a thick, tenacious exudation over the surface of the nasal mucosa and post-nasal space. Olfaction may become impaired. Objectively, the lower and middle turbinated bodies are observed to be distended at their anterior and middle aspect, pressing against the septum sufficiently to prevent seeing into the nasal fossa.

Nodular masses or irregular swelling of the mucosa may be frequently detected at some portion of the mucosa of the lower turbinate, and are soft and movable. The swollen mucous membrane perceptibly recedes on the application of cocain. The color of the mucous surface varies in individuals from a pale pink to a deep red. The posterior portion of the lower turbinates may be found hypertrophied. The latter condition is sometimes observed when the anterior portion of the turbinates is approximately normal in size (see Fig. 35). On account of the very great blood supply of the posterior turbinates, they are predisposed to a passive congestion and subsequent hypertrophy.

Diagnosis.—Upon inspection, the mucous membrane of the septum and lower turbinate appears reddish or grayish-red in color. The lower turbinate sometimes impinges on the septum and floor of the nose, the point of contact being the anterior or posterior portion of the turbinated bodies.

Hypertrophy may be differentiated from hyperplasia by the spongy quality or softness of the mucous membrane and the tendency to contract under cocain in the former condition, whereas, in the latter, or hyperplasia, the tissue recedes but little under cocain and is much harder to the touch.

The middle turbinate is susceptible to various changes and may be swollen and slightly paler than the lower turbinate. The size and shape of the middle turbinate, which is frequently seen touching the septum and twisted about at different angles, vary. With the development of air spaces in the middle turbinated bone, complete closure of the nasal fossæ may occur.

In the posterior hypertrophies, the rhinoscopic mirror may show swollen, grayish nodular masses partially filling the post-nasal spaces. Marked irregularities of the cartilage and bony septum may be present.

The amount of secretion observed in the nose may vary in individuals. There is usually a profuse amount of secretion along the floor of the nose and under the lower turbinated bodies. The conjunctiva is more or less reddened and the patient may complain of epiphora, which is due to hypertrophy of the mucous membrane of the lachrymal duct, especially about the nasal opening of the duct.

The ear symptoms are referred to under Diseases of the Middle Ear and Eustachian Tube.

Treatment.—Very few cases of hypertrophic rhinitis are amenable to simple treatment. Should the hypertrophy be of a mild character, resort may be had to warm cleansing alkaline spray, followed by a spray of zinc sulphate, three grains to an ounce of water and this by campho-menthol two per cent. in albolene. By this method, the prolific discharge may frequently be lessened. When the connective tissue deposits are the result of years of successive attacks of acute rhinitis, only radical measures are of value and consist in

the application of chromic acid fused upon a probe, electro-cautery, cold snare, general surgical measures or electrolysis.

D. Braden Kyle recommends making a V-shaped incision along the thickened turbinated bone, which portion is removed by saw, scissors or snare loop. A portion of the bone is then removed by means of strong alligator jaw forceps. The tissues are then approximated and held in position by splints of gauze.

Bryson Delavin recommends passing a knife deep into the submucosa, severing the intercellular tissue with a sweeping motion. The knife is then withdrawn without enlarging the opening. The hemorrhage is profuse for a few seconds. Contraction without reaction takes place and relief is frequently permanent. Following the operative procedure, the nose should be treated with alkaline and astringent sprays until the abnormal condition of the surface has passed away and the discharge has ceased. A persistent, chronic nasal discharge is always suggestive of involvement of the sinuses.

Turbinectomy.—This operation is frequently indicated in hypertrophy and hyperplasia of the turbinated bodies. The term, turbinectomy, may be applied to the removal of either one of the turbinated bodies. It must be understood, that, on account of its anatomical position, it is nearly an impossibility to completely remove the lower turbinated body. We propose to use the term "turbinectomy" in a more restricted sense and apply it to the removal of the lower or inferior turbinate (for description of removal of the middle turbinate, see Diseases of Ethmoid Cells).

Indication.—The turbinate bones may partially or completely obstruct nasal respiration from exostosis or over-growth of bone tissue or cysts of the bony structure, independent of any structural change in the mucosa. In addition to the hypertrophy of the bony structure, we may have an hypertrophy or hyperplasia of the mucosa. The removal of the latter condition, when bone hypertrophy is present, by one of the many methods, such as snare, cautery, electro-cu ting instrument and caustics, is contraindicated for the reason that sufficient breathing space cannot be obtained.

Adhesion of the enlarged lower turbinate to the septum from ulceration or attempt at palliative measures by some of the methods

enumerated above are frequently encountered, necessitating the radical operation.

From congenital or acquired influence, the vomer may curve to the right or left sufficiently to press upon the posterior portion of the turbinated body. It is sometimes inadvisable to try to remove such deformities, on account of the danger of perforating the vomer, and in consequence turbinectomy is indicated.

Malignant growths may be observed growing from the turbinated bodies which require the radical operation of turbinectomy or no operation at all.

Many rhinologists oppose the complete removal of the lower turbinate, believing that the contiguous mucous membrane may undergo an atrophic degeneration.

The patient sometimes complains of too much air entering the nasal passages predisposing to pharyngeal irritation on account of being insufficiently warmed and moistened.

Along the line of cicatrix, there is an absence of mucous glands and therefore crusts may accumulate at this point, greatly annoying the patient.

It is a question whether the advantages gained by the complete removal of the lower turbinate are greater than those gained by the partial removal of the body.

Dr. Dudley Reynolds, of Louisville, Kentucky, at a meeting of the American Academy of Ophthalmology and Oto-Laryngology, reported fifty cases showing the turbinates removed in which no ill results had occurred. Some of the cases had been under observation for as long a period as fifteen years.

There can be no great immediate danger of hemorrhage after turbinectomy or turbinotomy provided the patient is immediately placed in bed and the nose is frequently sprayed with iced Dobell's solution one-third strength, and adrenalin chlorid, one to three-thousand. This should be continued at an interval of one hour for twelve hours.

Method.—The face and vestibules of the nose should be previously cleansed with a hot solution of soap and water, the nasal cavity and post-nasal space thoroughly cleansed with some mild

alkaline wash, followed by an irrigation of warm bichlorid solution, 1/5,000.

Adrenalin chlorid 1/1,000 should be applied to the nasal mucosa with a spray or a cotton-tipped probe. After complete blanching of the mucous membrane, a five per cent. solution of cocain should

FIG. 109.—HOLMES'S SAWS.

be thoroughly applied to the inferior and superior portions of the turbinated body. Adhesions of the turbinate body with the septum are now broken up with a knife or scissors.

The bone can be quickly severed with a saw propelled by hand or electric motor, placed beneath the turbinated body near the articu-

FIG. 110.—JACKSON'S TURBINATE SCISSORS.

lation with the maxillary bone and directed upward and toward the septum of the nose.

The mucosa and connective tissue are cut through with a strong pair of nasal scissors. The turbinate can afterward be removed with a fixation forcep. The bone may be so large sometimes as to require a little force in extracting.

Dr Jackson, of Pittsburg, has devised strong nasal scissors which

may be used for cutting through the bony structure. There is necessarily more or less splitting of bone in the use of scissors.

Following the removal of the turbinated body, small spicula of bone, shreds of hanging mucous membrane and remnants of adhesion with the septum should be removed with a pair of scissors.

Adrenalin chlorid is now applied to the surface of the nose followed by irrigation of a cold solution of bichlorid of mercury, 1/5,000. The patient is immediately put to bed for twenty-four hours. A solution of Dobell's in a strength of one to three, combined with adrenalin chlorid in a strength of 1/3,000, should be sprayed ice-cold into the nose every half hour for twelve hours, after which the adrenalin chlorid may be suspended and Dobell's solution continued for twelve hours.

Ice packs of gauze or cotton dipped in ice-water should be kept upon the nose for the first twelve hours. Following this precaution against hemorrhage and infection, the nasal cavity is dusted with a powder of aristol and stearate of zinc in equal parts, twice or three times daily until recovery is complete. The patient may be allowed to go about the room or ward after twenty-four hours, but should be instructed to place a small amount of cotton in the side of the nose operated upon, in going out into the street, to filter the air and prevent, as far as possible, any infection being carried to the exposed surface.

Turbinotomy.—By this operation is meant the partial removal of one of the turbinates or turbinated bodies.

Turbinotomy is indicated in anterior and posterior hypertrophies and in hypertrophy or hyperplasia of the mucous membrane where turbinectomy is contraindicated. It is also indicated for the removal of malignant growths of the turbinated bodies, in hypertrophy of the middle turbinates which press unduly against the septum and interfere with the function of the naso-frontal duct or anterior ethmoidal cells and in hypertrophies which are too great to try shrinkage by electro-cautery or escharotics. The operation of turbinotomy or turbinectomy is always indicated in hyperplasia with obstruction. In hyperplasia with little or no cavernous tissue, the cautery or escharotics is contraindicated.

Adhesion which is frequently prone to occur with the septum after turbinotomy may be prevented by using the hard-rubber splint devised by Pynchon.

The preparation of the patient for turbinotomy is the same as for turbinectomy.

For the surgical removal of hypertrophies or hyperplasia, we may choose scissors, cold snare, biting forceps or electro-cautery.

The small wire loop of the cold snare can usually be placed about the over-growth, and by a quick, steady pull, the tissue is quickly removed. The cold snare is especially devised for the removal of anterior hyperplasia of the middle turbinate, taking precedence in this location over the hot snares. In snaring the tissue away, there is always the danger of incomplete removal of the hypertrophy.

The electro-cautery may be used for the removal of the anterior or posterior hypertrophies of the lower turbinates with little or no bleeding. There is always danger in using the cautery in that we may destroy too much tissue by over-heating the cautery loop, or the current may become interrupted from some untoward accident which will cause the loop to adhere to the tissue with so much force as to make its removal difficult and very embarrassing to the operator.

Of the scissors applicable for this operation, those possessing the greatest strength are advised. Small, weak, narrow-bladed scissors have but little place in nasal surgery.

Jackson's or Knight's scissors are especially recommended.

The nasal cavity is cleansed of all debris following turbinotomy. The patient should immediately be placed in bed, the nasal cavity should be sprayed every hour with a solution of Dobell's and adrenalin chlorid 1/3,000. Precautions should be taken to avoid hemorrhage and infection if the operation is performed in the office of the surgeon. Hemorrhage is a *bête noire* of nasal surgery, following more often if the patient is allowed to be other than perfectly quiet following the operation. Hemorrhage may not alone follow after the use of cutting instruments, but may be very severe after using the electro-cautery, frequently coming on a number of hours after the operation.

It is very difficult to plug the posterior nares, consequently the

patient should be immediately put to bed in all operations upon the posterior turbinate. After removal of hypertrophy in the anterior nasal cavity, if it is necessary for the patient to travel a long distance or hemorrhage is anticipated, a small strip of gauze should be dipped in a two per cent. solution of camphor and menthol and applied to the cut surface. Strips of antiseptic gauze sufficient to totally plug the anterior nares should be gently packed over this. The gauze, with the exception of the small particle of gauze covering the wound, can be removed the following day without hemorrhage or pain. The remaining gauze can usually be removed in forty-eight hours without hemorrhage. Adrenalin chlorid can be previously applied to the wound, if we suspect hemorrhage. The nasal cavity should be cleansed twice daily with a warm alkaline solution until recovery is complete.

Atrophic Rhinitis.—Atrophic rhinitis is a condition of the mucous membrane and turbinated bones characterized by atrophic degeneration of the entire structural elements, often extending into the pharynx.

Etiology and Pathology.—The etiology and pathology of atrophic rhinitis is still a disputed question.

Bosworth maintains that atrophic rhinitis results from purulent rhinitis in childhood, which produces suppuration of the glands and subsequent destruction; Gruenwald, that the disease is permanently situated in the accessory sinuses; Boyer and Woakes, that the disease is presumably of a neuropathic origin; Colowa and Cordes, that the disease begins essentially in the bone and extends to the mucosa of the turbinate. Atrophy of the bone and absorption take place from the presence of osteoclasts. There is a reduction of the blood supply and consequent lessening of the glandular secretions. The secretion covering the turbinates is, to a great extent, made up of wandering leucocytes and because of the absence of mucus, odor-producing bacteria find a suitable soil for propagation.

Among the predisposing causes of atrophy are congenital malformation of the head and nasal passages, especially in flat type of faces, spurs, deviation of the septum, exanthematous diseases, syphilis and congenital dyscrasia.

Hajek discovered the bacillus fetidus ozonæ in the secretion and

believed it to be the cause of the disease, but by many the presence of the bacillus is believed to be accidental.

Symptomatology.—The symptoms are conspicuous dilation of the nasal fossæ and partial or complete atrophy of the middle and lower turbinated bones. Thick muco-purulent slugs of tenacious, ill-smelling pus may be observed on the lower and post-nasal space. The characteristic fetor observed in such cases is due to saprophytic infection. Two forms of the disease are observed, those with and those without fetor.

Treatment.—The treatment may extend over many years and is often very unsatisfactory. The surface is first cleansed of the thick tenacious mucus, which is more conspicuous in the post-nasal space, with a warm alkaline fluid in the post-nasal douche.

℞ Sodii biboratis, Sodii bicarbonatis, āā	.60 gm. (gr. x)
Sol. antiseptici (Lister),	3.75 c.c. (ʒ j)
Phenol,	.18 c.c. (m. iij)
Aquæ destill.,	60.00 c.c. (℥ ij)

Resort must be made to probe and cotton to remove the secretion when it resists the douche. After thorough cleanliness is secured, if there be any localized pus infection, the surface can be dusted with powdered stearate of zinc to which is added sixty grains of orthoform to the ounce. Brown, Bishop, Braun and others report flattering results from massage. Douglas recommends the application of a ten to twenty per cent. watery solution of ichthyol after the surface has been thoroughly cleansed. Tampons of cotton saturated with ichthyol or ichthargon are allowed to remain in the nose for twenty minutes, sufficient time for absorption to take place. This is followed by an oil spray. The treatment is administered every other day.

Dr. D'Onisio recommends radium. The cone should be applied to the nasal cavity once weekly. M. Broeckaert recommends a small quantity of paraffin injected into the turbinate mucosa. The amount injected varies and should be sufficient to restore the symmetry of the lower turbinate.

As a spray to the atrophic mucous membrane, James E. Newcomb recommends a tablet containing mucin and bicarbonate of soda and one grain of menthol, one tablet to be dissolved in one-half ounce each of sterile water and sterile lime water. A fresh solution should be made every two or three days. Newcomb reports very good results from the above spray, especially in the relief of the odor and dryness of the mucosa. In involvement of the sinuses, they should be opened and drained. In suspected involvement of the sinuses, a fluoroscopic examination should be secured to ascertain their size and position. The sinuses show darker than usual in atrophic rhinitis. Constitutional treatment necessarily varies with the cause producing the disease.

Fibrinous Rhinitis.—Fibrinous rhinitis is an acute inflammation of the mucous membrane of the nose, more often seen in children. It is of a pathogenic origin and is characterized by deposits of fibrinous material upon the mucous surface.

Etiology.—The disease may occur from direct infection from the Klebs-Löffler bacillus, the streptococcus or the pneumococcus and may follow cauterization of the turbinates and operations on the septum or turbinated bodies.

Pathology.—As in croupous exudation in the larynx or conjunctiva, there is a whitened, glistening, tenacious exudation, composed of coagulated fibrin, thrown out upon the surface sometimes filling the nose.

Symptomatology.—There may be a history of headache, slight chills, rise of temperature, general systemic infection and symptoms of acute coryza. However, the disease may occur without the above preliminary symptoms other than stenosis and exudation from the nose. The discharge is fibrinous or muco-purulent and copious in quantity. The disease may extend to the pharynx and tonsils. The area of involvement may be limited to the anterior nares or may extend to the pharynx, tonsils and larynx. Taste and smell may be absent.

Diagnosis.—The disease should not be confounded with diphtheritic or syphilitic rhinitis. It is best to isolate the patient, pending bacteriological diagnosis. Upon inspection of the nose, a thick,

grayish exudation is observed covering a part or the whole of the mucous membrane, especially the respiratory region of the nose. The croupous character of the membrane is easily demonstrated with a cotton-tipped probe. The lower turbinated body may appear swollen, impinging upon the septum. The membrane is removed with difficulty. If mixed infection occurs, there may be severe hemorrhage from the nose upon mechanical removal of the exudation. Atresia may occur from ulceration, especially in individuals past the middle age.

Prognosis.—The prognosis is favorable regarding life. Adhesions between the turbinates and septum sometimes occur, producing partial stenosis. The disease in adults runs its course in from a week to ten days and in infants from four or five days to four or five weeks.

Treatment.—The treatment consists in the internal administration of chlorid of iron in five to fifteen drop doses. The swollen turbinated bodies may be reduced by spraying with a two per cent. solution of cocain followed by a warm alkaline and antiseptic spray. The bleeding points should be touched with a ten per cent. solution of nitrate of silver and the mucosa dusted with equal parts of stearate of zinc and trypsin. A free purgative is usually indicated in the beginning of the disease. Dry heat should be applied over the nose, three times daily for one-half hour. Tonics are usually indicated for a few weeks after the symptoms of the disease have passed away.

Diphtheritic Rhinitis.—Diphtheritic inflammation is an acute inflammation of the mucous membrane of the nasal cavity, independent of or accompanying faucial involvement and is due to infection from the Klebs-Löffler bacillus.

Etiology.—The causes are both predisposing and exciting. Among the predisposing causes are epidemics of diphtheria which occur among children between the ages of two and fifteen years, unhygienic surroundings, lowering of the vitality and the acquired disposition of the mucous membrane to infection. The exciting cause of diphtheria is the Klebs-Löffler bacillus and is due to direct contagion. The organism may find lodgment within the nasal cavity during the act of inspiration. The disease frequently spreads from the nose to the pharynx or from the pharynx to the nose.

Pathology.—The pathology of nasal diphtheria varies in no wise from that of pharyngeal diphtheria. There is a necrosis of fibrinous exudation, which is thrown out upon the surface extending into the epithelium of the mucous membrane covering the turbinated bodies and septum. The disease may be localized or diffused and not infrequently involves the accessory cavities. There is a swelling of the

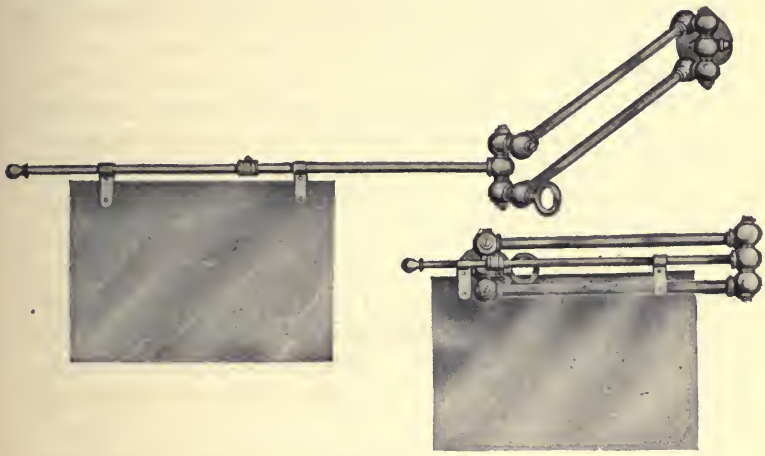

FIG. 111.—FREEMAN'S FACE SHIELD.

lymphatics as in faucial diphtheria and meningitis, broncho-pneumonia and local palsies may follow the disease. Pathological changes, the sequelæ of the disease, vary in no wise from those observed in faucial diphtheria.

Symptomatology.—The symptoms of the disease are a stenosis of the nose with a profuse, slightly fetid discharge from the nose, creamy in color. There is a general debility, enlarged cervical glands which are usually present though may be absent, rapid pulse and slight elevation of temperature. The disease is more often observed in children under seven or eight years of age. The pseudo-membrane adheres to the mucous surface and upon removal leaves bleeding points. The temperature may rise as high as 105° and is usually greater than in the faucial form. The Klebs-Löffler bacillus is

always present. Albuminuria may also be present. Local palsies may follow as in faucial diphtheria.

Diagnosis.—As a rule, the child first complains of a stoppage of the nose and a more or less thickened white or yellowsh-white irritating discharge from the nose. There is slight elevation of temperature with general systemic infection.

Prognosis.—A guarded prognosis should be given for fear of extension to the larynx and severe general infection.

Treatment.—The local treatment consists in irrigating with a warm Dobell's solution, followed by dusting with trypsin. Antitoxin, 5,000 units, should be injected, followed by the administration of chlorid of iron in fifteen drop doses four times daily. If, after six or eight hours, there is no amelioration of symptoms, an additional four or five thousand units of antitoxin should be injected. Purgation should be encouraged by the hourly administration of calomel in one-tenth grain doses. The patient should be isolated.

Caseous Rhinitis.—Caseous rhinitis is an infrequent form of inflammation of the nasal fossæ, characterized by the formation of thick, cheese-like exudations, over a granulating and bleeding surface.

Etiology and Pathology.—The disease is presumed to be due primarily to some nasal obstruction sufficient to produce a retention of secretion, followed by infection with the streptothrix alba. The exudation resembles cholesteatomite, and is described as such by Grant. On account of the damming back of the secretion, the sinuses not infrequently become filled with cheesy masses, which may destroy the bony framework, and even perforate the brain cavity. There is a general lowering of the vitality of the mucous membrane and connective cells, with the formation of soggy granulating tissue.

Diagnosis.—The disease is characterized by a general lowering of the vitality of the individual. There is rapid emaciation, general weakness, loss of appetite, and sometimes severe hemorrhage from the ulcerated surface. The deep necrotic area resembles that of syphilis or tuberculosis. The disease should not be confounded with syphilis, tuberculosis, or glanders.

Treatment.—On account of the resemblance of the disease to syph-

ilis, and sometimes difficulty of differentiation, in doubtful cases mercury should be given.

The local treatment consists in curettement of the nasal cavity, exploration of the sinuses in suspected involvement, and flushing the cavity frequently with Dobell's solution.

In involvement of the hard palate, the surface of the ulcer should be touched daily with a four per cent. solution of nitrate of silver.

In involvement of the antrum, a free exposure of the cavity can best be secured by opening through the canine fossa. As a rule a general anesthetic is necessary to curette thoroughly.

Specific Rhinitis.—Specific rhinitis is a local manifestation of syphilis and may be congenital or acquired.

Congenital Syphilis of the Nose.—In the congenital form of the disease, we have the secondary and tertiary manifestations. As a rule, a syphilitic mother or father will beget syphilitic children. The period of least liability to transmit the disease is the tertiary stage. It frequently occurs that strong and apparently healthy children are born of a father or mother suffering from syphilis.

Colles's law is, that an infant with inherited syphilis will not infect its mother but will infect its wet-nurse.

L. D. Buckley reports having seen a grandmother with a chancre within the nostrils followed by the most severe syphilis with prolonged brain symptoms, who had received the infection from a syphilitic grandchild, who had died of the disease.

Symptomatology.—The disease more frequently manifests itself in the form of an acute coryza with excoriations about the meatus of the nose from the fifth to the tenth week after birth. Phlyctenular keratitis or iritis may accompany the disease. A chronic, purulent, offensive discharge from the nose may be the one symptom present.

Diagnosis.—The diagnosis depends to a great extent upon the clinical symptoms and history of the disease. The child may be anemic with a muco-purulent discharge from the nose, excoriations about the meatus, enlargement of the cervical glands and eruption on the skin typical of syphilis.

In clinical cases especially, the disease has reached the stage of ulceration and necrosis before coming under the observation of the

rhinologist. The variety of ulcerative conditions presented are equal to the possibilities. The septum may alone be destroyed, the vomer, the nasal bones and external nose producing a complete col-

FIG. 112.—CONGENITAL SYPHILIS OF THE NOSE IN A BOY TWELVE YEARS OF AGE. The columnar and septal cartilage destroyed.

lapse of the nose. The illustration (Fig. 112) shows a complete destruction of the columnar cartilage and septum of the nose. In this case there was partial necrosis of the vomer. The nasal bones

were normal and in consequence there was no external deformity other than the destruction of the columnar cartilage and the skin covering the same.

FIG. 113.—PROFILE OF THE BOY SHOWN IN OPPOSITE ILLUSTRATION SHOWING SLIGHT DEFORMITY.

As a further aid to diagnosis, the Justus hemoglobin test may be made, which consists in first making a hemoglobin estimation, followed by an inunction of mercury. After twenty-four hours,

a second hemoglobin test is made and if there is a ten to twenty per cent. reduction of hemoglobin, syphilis can be expected.

Course and Prognosis.—As a rule, the prognosis is favorable if the disease manifests itself a number of weeks after birth, is easily detected and the child is well nourished. In well-advanced cases with profound cachexia and anemia, the prognosis is unfavorable.

Treatment.—The constitutional treatment in the beginning of the disease consists in inunctions of mercury. In the application of ointment, 20–40 grains of an equal part of mercurial ointment and lanolin should be rubbed into the skin once daily, beginning at the inner surface of the right arm, right leg, left arm, left leg, chest, and abdomen. This form of treatment should be continued until slight symptoms of salivation are manifest. Mercury by the mouth usually produces griping and intestinal disorders. Gottheil highly recommends subcutaneous injection weekly of one-half grain of salicylate of mercury dissolved in fluid cosmoline or alboline. Each drop of the solution is to represent one-tenth grain of the salicylate, and five-sevenths of a drop constitutes a dose. Each injection is made deep into the glutial muscles with the patient standing in an upright position.

Benjamin Brodie recommends for a child, spreading mercurial ointment made in the proportion of one drachm to an ounce of lanolin over a flannel roller and binding it around the child once a day. This treatment, according to Brodie, cures the disease. Mercury may be given by the mouth. Mercury in the form of calomel may be given in one-tenth to one-half grain doses three times daily when the inunction produces irritation. In well-marked gummata or ulcerations, iodid of potassium in syrupy solution may be combined with the mercury and continued for a long time after all the symptoms of the disease have passed away. There is a syphilitic dyscrasia present in children of syphilitic parents, which manifests itself in a tendency to coryza and a general weakness of the mucous membrane and responds to small doses of mercury and iodid of potassium.

The local treatment consists in cleansing the nasal cavity with a warm alkaline and antiseptic solution. The crusts which form in the nose and about the meatus may be softened with albolene. The parts may be dusted with stearate of zinc after cleansing the nasal

cavity. In ulceration of the septum it is sometimes advantageous to frequently touch the bleeding surface with a solution of nitrate of silver, twenty grains to the ounce of water.

Acquired Syphilis of the Nose.—The primary lesion, or hard chancre of the nose, is exceedingly rare. Bosworth says: "In two thousand, two hundred and forty-four cases observed by Bas-

Fig. 114.—Tertiary Syphilis of the Nose.

serean, Clerg, Lefort, Fournier and Ricard, the lesion was found in the nose twice. The site of the lesion was upon the cartilaginous septum." The chancre of the nose differs but little from the classical chancre.

The secondary lesion, or mucous patch in the nose, like the primary lesion, is infrequently found. The location of the mucous patch is usually at the junction of the skin and the mucous membrane. The secondary lesion should appear in from three to six weeks following infection and observable for as long a period as three years. Superficial abscess of the mucous membrane may appear at this

period of the abscess and in general appearance is not unlike a diphtheritic patch. Ulceration may involve both the septum and the turbinated bodies. Acute and chronic rhinitis is a frequent complication of secondary syphilis.

Symptomatology.—The symptoms of secondary ulceration are difficult breathing in one or both sides and a slight watery and sometimes offensive discharge from the nose.

Diagnosis.—The diagnosis of ulceration without a history of syphilis or preliminary administration of the iodids, is very difficult. Upon inspection, the lower turbinated body is usually seen to be swollen and edematous. A necrotic membrane is found covering the surface of the ulceration, which causes bleeding upon being disturbed. The turbinate and septum may be found agglutinated with the necrotic and granular mass. When the turbinate and septum are separated with a probe, bleeding occurs. The turbinates are thick and edematous and contract but slightly under cocain.

Treatment.—The treatment of the secondary lesion is directed to the relief of the constitutional infection by inunctions of mercury for ten days, followed by proto-iodids of mercury, one-half to two and one-half grains per day, and small doses of iodid of potassium.

The local treatment consists in breaking up the adhesions between the septum and the turbinate, cleansing in fifty per cent. peroxid of hydrogen once daily, irrigating twice daily with Dobell's solution followed by insufflation of stearate of zinc.

Tertiary Syphilis.—The tertiary lesions of syphilis of the nose, are, according to Morrow, "gummata, diffuse infiltration, deep ulceration and fibroid degeneration."

The gumma tumor is the first evidence of tertiary lesion. The site of the gumma is more often in the septum and floor of the nose. Gumma may be found in the turbinated bodies and posterior nares. The mucous membrane, bone, bony septum, periosteum or cartilage may be the primary site of the lesion. Syphilis of the nose manifests a predilection for the cartilaginous structures. Ulceration and perforation of the bony septum may take place without involvement of the cartilaginous septum. The ethmoid cells are probably next in frequency of invasion.

Symptomatology of Gummata.—The symptoms of gummata are indistinct and ill-defined. There is usually nasal obstruction in one or both sides of the nose and pain of a deep and boring character. The symptoms of ulceration are bloody discharge from the nose, accumulation of thick crusts, ozena, foul-smelling pus in extreme cases, alteration of the voice, and sometimes deformity of the nose. The internasal form of the disease is extremely insidious and frequently great destruction of tissue results before the symptoms are sufficient to cause the patient to seek relief.

Diagnosis of Gummata.—A gumma should be differentiated from deflected septum, malignant and non-malignant tumors, chondroma or enchondroma. The tumor is round, and in the early stages, hard to the touch. The mucous membrane covering the tumor is usually normal in appearance, changing with the growth of the tumor to a pale color. As the tumor grows, disintegration takes place and is followed by softening and suppuration.

In the case illustrated, a gumma evidently formed in the nasal bone, producing necrosis and a fistula, which was closed externally by surgical measures.

External gummata are frequently encountered and may bring about destruction of the skin and lateral cartilage and often extend to the bone, with destruction of the internal nose.

Deep ulceration with destruction of tissue results from disintegration of the nodules. There is little or no pain in external ulceration. The disease is progressive. The surface is covered with brownish crusts, formed by the drying mucus and pus. Ulceration is in progress and pus forms in great quantities beneath the crusts.

Granulation tissue may spring from a gumma and completely fill the nasal cavity, and as the tumor bulges from the nose, it resembles a malignant growth in general appearance. The syphilitic cachexia accompanying this form of inflammation is well marked.

Fibroid degeneration of connective tissue, or hyperplasia, in tertiary syphilis usually involves the turbinated bodies, which are enlarged, hard and whitened in appearance, and according to Morrow, is a distinct, pedunculated growth, resembling a polypus.

The hard palate will frequently contain one or more necrotic ulcers in syphilitic granulations. The granulation may involve the sinuses, especially the ethmoid. The odor from the nose will be more or less offensive.

Diagnosis of Tertiary Syphilis.—The diagnosis of tertiary syphilis of the external nose is comparatively easy. The disease may resemble cancer or septic ulcer. A deep, indolent ulcer of the external nose, which does not quickly respond to local antiseptic measures, in the absence of a history of syphilis, should be presumed to be syphilis and treated as such until the diagnosis is established.

Perforations of the septum are not always pathognomonic signs of syphilis. They may result from trauma, infection from picking the nose, abscess, chemical irritation, infection from diphtheria, smallpox, typhoid fever and tuberculosis. Perforations of the septum consequent upon active syphilis are usually covered, especially on the posterior half, with blood crusts which are blown from the nose or detached by a probe, leaving a bleeding surface.

As a rule, saddle nose is due to necrosis of the bony septum. As long as the necrosis is confined solely to the cartilaginous septum, the nose retains approximately its normal contour, as shown in Figure 112.

The odor of necrosis of the bone due to syphilis is variable and is frequently so offensive as to defeat in descriptive power the ordinary observer. The odor is peculiarly offensive when the sinuses are involved and the residual air therein is completely saturated with the stench of decomposition. Necrotic bone in the nose may be detected with a cotton-tipped probe.

Prognosis of Tertiary Syphilis.—The prognosis, as regards the removal of gummata, is exceedingly good. Fatty degeneration and absorption may take place under antisyphilitic treatment.

When the disease has advanced to the stage of deep ulceration and necrosis of bone the prognosis is usually unfavorable. As a rule, spicula of bone are thrown off and healing takes place with a suspension of all symptoms. Deep ulcerations without bone involvement heal in a few weeks with formation of dense cicatricial tissue. As a rule, the odor disappears with the removal of all dead bone.

Treatment of Tertiary Syphilis.—The treatment of gummata and ulceration consists in the administration of the mixed treatment.

℞	Kali iodidi,	1.30 gm. (gr. xx)
	Hydrarg. bichloridi,	.004 gm. (gr. $\frac{1}{16}$)
	Syr. sarsaparillæ,	3.75 c.c. (℥ j)

Signa. To be administered well diluted.

The iodids must be pushed until the disease responds to the treatment. After cure of the local condition is accomplished, we depend upon mercury in some form to eradicate the disease from the system.

It may sometimes occur that tertiary lesions of the nose, as well as of the naso-pharynx, do not respond to the classical treatment as suggested above. Mercury and iodin may, as observed by many, accentuate the ulcerative processes and even produce new ulcerations in the nose and adjacent parts. Sir Felix Semon (*British Medical Journal*, Jaunary 13, 1906) relates a case of precocious tertiary syphilis of the throat and tongue of malignant type, evidencing exactly this condition. The treatment of the case by Semon was by Zittmann's and Robert's sarsaparilla decoction. The patient was given seven ounces of the stronger decoction in the morning and seven ounces of the weaker solution at night. Under this form of treatment the patient's health greatly improved and the ulcerations were replaced by solid scars. The formula of Zittmann's decoction is as follows (from Remington's Practice of Pharmacy, Page 334).

Decoctum Sarsaparillæ Compositum Fortius.—P. G. Zittmann's Decoction (Stronger).

Sarsaparilla, cut,	20 gm.	2 oz. av.
Water,	520 c.c.	50 fl. oz.

Digest for twenty-four hours, and having added

Sugar,	1 gm.	44 grains
Alum,	1 gm.	44 grains

expose them in a covered vessel, with occasional stirring, for three hours, to the heat of boiling water; then add to the mixture:

Anise, bruised,	1 gm.	44 grains
Fennel, bruised,	1 gm.	44 grains
Senna, cut,	5 gm.	½ oz. av.
Liquorice root, cut,	2 gm.	88 grains

Digest for a quarter of an hour and strain the liquid with expression. Allow the decoction to settle; then pour off the liquid, and, by the addition of water, bring it to 500 c.c. (or three pints).

Decoctum Sarsaparillæ Compositum Mitius.—P. G. Zittmann's Decoction (Milder).

Sarsaparilla, cut,	10 gm.	1 oz. av.
Water,	480 c.c.	46 fl. oz.

Digest for twenty-four hours, and expose in a covered vessel, with occasional stirring, for three hours, to the heat of boiling water or a water bath. Then add to the decoction:

Lemon peel, cut,	1 gm.	44 grains
Cinnamon, bruised,	1 gm.	44 grains
Cardamon, bruised,	1 gm.	44 grains
Liquorice root, cut,	1 gm.	44 grains

Digest for a quarter of an hour, and strain the liquid with expression. Allow the decoction to settle; then pour off the liquid and, by the addition of water, bring it to 500 c.c. (or three pints).

The formula of Roberts' preparation is the following:

Place 1 kg. of sarsa root in coarse powder in a closed vessel with 4 kg. of distilled water, and set aside for three hours, occasionally stirring; heat and keep boiling for one hour, then press out. Repeat this once more. Evaporate the combined decoctions until there remains 1 liter (quart), mix well with an equal volume of alcohol (90 per cent.), wash out the residue with boiling alcohol (90 per cent.) ½ liter, strain through flannel and filter, evaporate to ½ liter or less. Establish the quantity of parilli and sarsaponia according to the method of v. Schultz-Christophson, and adjust the strength of the finished product either by evaporating or by adding distilled water, so that it shall contain 2 per cent. of the above glucosids (Semon).

The local treatment consists in the careful removal of all crusts by irrigating twice daily with the following:

℞ Sodii bicarbonatis, Sodii biboratis, āā		.24 gm. (gr. iv)
Phenol,		.12 gm. (gr. ij)
Glycerini,		1.00 c.c. (gr. xvi)
Aquæ destill.,		30.00 c.c. (℥ j)

Any necrotic tissue which cannot be removed by irrigation should be removed by suitable forceps. The disagreeable odor can be disposed of by irrigating with the following every three hours:

℞	Potassii permanganatis,	.12 gm. (gr. ij)
	Ac. borici,	1.20 gm. (gr. xx)
	Aquæ tepidæ,	30.00 c.c. (℥ j)

Alcohol in any form is to be tabooed, nutritious diet is essential, out-door exercise, frequent baths and warm woolen clothing are very necessary adjuncts to the building up of the system.

Nasal Hydrorrhea.—Nasal hydrorrhea is, according to St. Clair Thompson, a profuse, watery discharge from the nose, continuous or remittent, without any visible pathological change in the nose or any apparent cause.

Etiology and Pathology.—The etiology and pathology are somewhat obscure. The disease is probably due to some irritation of the trifacial nerve or vaso-motor system, intrinsic or extrinsic, producting a serous exosmosis.

Diagnosis.—It is necessary in diagnosis, to differentiate nasal hydrorrhea from leakage of cerebro-spinal fluid.

Cerebro-spinal fluid is of low specific gravity and may contain sugar, is clear and transparent and does not dry quickly.

Upon examination of the nose, there is no apparent abnormality or congestion. The patient complains of the sudden and sometimes continuous watery discharge from the nose and compares it to the flowing sugar tree. The disease resembles the sensation that sometimes follows the filling of the frontal cells with salt water while in sea bathing, while after an hour or so a clear fluid suddenly trickles from the nose. The intensity of the disease varies from day to day and the disease frequently recurs at intervals of a few days.

Treatment.—The treatment is directed to the correction of any dyscrasia that may be present. The nasal cavity should be sprayed twice daily with Dobell's solution, followed by syringing with nitrate of silver, one-half grain to the ounce, followed by a spray of two

per cent. camphor and menthol in albolene. The following tablet may be given three times daily, between meals and at bed time:

℞	Atropin sulph.,	.0002 gm. (gr. $\frac{1}{300}$)
	Strychnin sulph.,	.001 gm. (gr. $\frac{1}{60}$)
	Morphin sulph.,	.003 gm. (gr. $\frac{1}{20}$)
M.	For one capsule or tablet.	

Ozena[1].—Ozena is considered a symptom rather than a disease, and is characterized by an offensive odor which takes its orgin within the nasal cavity.

Etiology.—The etiology of the condition is somewhat obscure. Ozenic odor may be produced by necrosis, syphilis, suppuration within the accessory cavities, atrophic rhinitis, malignant disease, glanders, and according to Abel, the bacillus mucosus.

On account of the frequency with which the accessory sinuses are involved in infectious diseases of childhood, such diseases may be considered extremely important etiological factors in ozena. The condition may be a tropho-neurosis, produced by the ptomains and toxins of microörganisms not yet differentiated. The odor is believed by some to result from the action of bacteria upon the secretion, and by others to be a peculiar chemical substance of the histological structures. Theisen reports in forty cases of ozena observed, fourteen patients had pulmonary tuberculosis and believed the ozenic condition to be a predisposing cause of tuberculosis.

Treatment.—The treatment varies according to the etiology of the disease. If the affection is due to syphilis, constitutional treatment and the removal of the necrotic bone within the nasal cavity are indicated. If atrophic rhinitis is the cause of the condition, submucous injection of paraffin to restore the normal size of the lower turbinated bones is indicated, as recommended by Fliess and others. According to Siziemsky, there is marked similarity between the toxin of the bacillus of ozena and that of diphtheria, and, in consequence, he recommends injection of diphtheria antitoxin. Siziemsky's percentage of cases cured or relieved by this form of treatment is reported very large.

[1]See Atrophic Rhinitis.

Where there is necrosis of the sinuses, which, according to Gruenwald, Herd and Lohnberg, is more frequently the cause of the disease, the radical operation for the curettement of the sinuses, which will be outlined in diseases of the accessory cavities, should be performed. The ozenic odors may first be detected by the patient. A history of offensive odors from the nose should be a clue for exploration of the ethmoidal and sphenoidal sinuses.

Hanine recommends citric acid in full strength or with equal parts of sugar of milk for the relief of the odor of ozena. The treatment does not irritate and the effect lasts for a number of days.

Anthrax (Malignant Pustule).—Anthrax is a not uncommon disease of man—usually acquired from handling hides, wool, or diseased animals. Infection occurs by direct inoculation into a scratch or wound, the most frequent site being the alæ or tip of the nose.

Etiology.—The disease is due to the bacillus anthracis, which finds entrance through some abrasion on the skin.

Pathology.—The anthrax bacillus is a long lived organism, and when exposed to the air, has the faculty of forming spores, which give vitality and longevity to the reproduction of the disease by inoculation. When the disease is transmitted from an infected animal or man, it is by the bacillus without the spores. The localized swelling from the inoculation with the anthrax, resembles ordinary carbuncle. Infection may take place in any part of the alimentary mucosa, especially in the mouth or pharynx, with edema, hemorrhagic extravasations, pustules, and sometimes the formation of abscesses. The period of incubation lasts from one to three days.

Symptomatology.—The important symptom is intense itching, with the appearance of a small red papule resembling flea bite. In a few hours, this forms a vesicle, containing a brownish serum, which usually contains anthrax bacilli. If this vesicle is not infected, it usually dries up, leaving a brown scab. Owing to the intense itching, it usually becomes infected, forming a distinct pustule. The picture is much the same as a vaccination pustule, and may be

mistaken for it. It rapidly dries up, forming an ulcer with indurated edges and a clean base, black in color (gangrenous). The whole is very painful, but on the development of the black color, becomes less so. It may be markedly edematous. The constitutional symptoms are usually slight.

Diagnosis.—The diagnosis is usually confirmed by a bacteriological examination.

Prognosis.—The prognosis is guardedly favorable, depending upon the amount of systemic involvement. If the patient shows marked systemic involvement, the case is usually hopeless.

Treatment.—The treatment should be very radical. Excise all infected area, going well beyond the border of the ulcer. If excision is not possible on account of the location of the ulcer, inject a ten per cent. solution of carbolic acid in the outer border to arrest its progress, and dress with strong antiseptics. Whittaker uses powdered corrosive sublimate as a dusting powder. Twenty per cent. ichthyol in glycerin is highly efficacious.

Glanders.—Glanders is an acute or chronic infectious disease, characterized by the formation of nodules and ulcers in the mucous membrane or skin of the nose.

Etiology.—The disease is due to the presence of the bacillus mallei. Among the lower animals in which the disease is found are the horse, mule, ass, sheep, goat, rabbit and dog. The disease is more frequently contracted from horses and observed in men who habitually come in contact with horses. The avenue of infection may be through a scratch or break in the skin or mucous membrane, from the virus being blown in the face by the snorting of the horse or carried to the nose by infected hands. The disease may be transmitted from man to man.

Pathology.—Small ulcerations or nodules may form on the skin or mucous membrane or the juncture of the skin and mucous membrane. The glanderous nodule forms a welt or papule, at the apex of which a small pustule forms, which later becomes infiltrated with blood and may break down and form an ulcer. The ulcerated condition may extend to the accessory sinuses, pharynx, palate, larynx, middle ear and cochlea.

Symptomatology.—The period of incubation is from "three to eight days." According to Warren, there is "first a dryness in the nasal mucous membrane, and almost always there is hemorrhage. This is followed by tension about the root of the nose and swelling of the mucous membrane. The discharge is first scanty and is followed by a thick, tenacious, bloody mucus, which later becomes dirty yellow in color and extremely foul in odor. Pustules and ulcers may be seen upon the mucous membrane and perforation of the septum may occur." The pulse is rapid at first, gradually becoming slower as the gravity of the disease increases. Coma or tetanic spasm may precede death.

In the chronic form of the disease, there may be a slow process of destruction of bone, perforation of the septum, general infection, muco-purulent discharge from the nose and a wasting away of the body.

In the cutaneous form, ulcers may form, heal and reform. The pustules fill with pus, subsequently break down and form ulcers.

Diagnosis.—With a history pointing to infection from horses, the symptoms as enumerated above and the discovery of the presence of the bacillus mallei in the secretion, the diagnosis is clear. The disease may be mistaken for syphilis or tuberculosis.

Prognosis.—The acute form of the disease usually terminates fatally in from one to three weeks (Morrow). In the chronic form of the disease, patients seldom recover, the disease producing death by a slow process of growth.

Treatment.—The treatment, though practically useless in the majority of cases, consists in supportive measures, together with antiseptic nose and throat douches and sprays (Lennox Brown).

Lupus.—Lupus of the nose is essentially a tubercular inflammation of the skin and mucous membrane, characterized by the formation of minute reddish-brown nodules which may subsequently suppurate and produce destruction of tissue and dense cicatrix. Two well-known classifications are lupus erythematosus and lupus vulgaris.

Lupus of the nose usually begins as a small macule, situated in the skin covering the nose, due to tubercle bacillus. The disease is usually slow in its course and may remain superficial or extend

deeper and involve the bony structure. The affection may take its origin on the nose and spread to the cheek and mouth.

Etiology.—The predisposing causes of the disease are the predisposition to tuberculosis, lowered vitality and local irritation. The disease often begins in youth and manifests itself in middle life. The disease may originate primarily in the mucous membrane, but in the majority of cases involvement of the mucous membrane is secondary to infection of the external nose. The exciting cause of this morbid condition is the tubercle bacillus.

Symptomatology.—In the early stages of the disease, the objective symptoms are the presence of reddish-brown nodules, somewhat transparent, at the tip or alæ of the nose. The tissue surrounding the nodules is brownish and discolored. Thick, dry scabs are formed during the process of ulceration, followed by the formation of deep scars. There is usually a history of exacerbations of the disease.

The subjective symptoms in involvement of the mucous membrane of the nose, are nasal stenosis, slight pain and a sero-mucous discharge. In involvement of the skin alone, the patient may complain only of the formation of scabs.

Should the disease advance to the destructive stage, as shown in the illustration (Fig. 115), there will be total nasal stenosis, atresia of the mouth, inability to articulate distinctly or take other than liquid food.

Pathology.—The usual site of the lesion is in the tip or alæ of the nose. Lupus is observed to be at first reddish-brown nodules, somewhat transparent and covered with true skin and may be single or confluent. In seventy per cent. of cases of lupus vulgaris treated in Copenhagen by Professor Finsen, the mucous membranes were involved, and not uncommonly, the nasal mucous membrane was first involved. In structure the nodules resemble a submiliary tubercle and contain granulated tissue, giant cells and leucocytes.

There is a tendency to ulceration, with involvement of large areas of surrounding tissue. Perforations of the septum are sometimes observed. With the exacerbations of the disease, deep cicatricial tissue is formed. During the process of ulceration, the surface is covered with brownish scabs and the tissue becomes soft and granular.

Diagnosis.—The disease resembles syphilis and may even be taken for rhino-scleroma. In the non-ulcerative form of lupus, small brownish-red tubercular nodules are observed in the skin or mucous membrane, which may disappear by a process of absorption and desquamation of the epidermis with formation of deep channels of cicatricial tissue. Upon detachment of the brown crusts in the ulcerated form of the disease, there remains a soft,

FIG. 115.—LUPUS OF THE NOSE AND MOUTH.
Case, age thirty-five.

granular ulcer covered with mucus. Grasping the tissue with a fixation forceps, the tissue forming the periphery and base of the ulcer is found to be soft and is detached as a granular mass. The soft tissue can be removed with but little hemorrhage with a curette. The pain from curettement is very severe. A history of prolonged nasal discharge should suggest the possibility of lupus.

The disease is differentiated from syphilis by its failure to re-

spond to antisyphilitic treatment, from epithelioma by microscopical examination.

Treatment.—The treatment is usually curettement in the ulcerative stages and the daily application of the X-ray together with the correction of any constitutional dyscrasia. Plastic operation may be resorted to for the correction of the nasal deformity.

In the presence of the nodular variety, the Finsen light or the X-ray offers the speediest relief. In the absence of the Finsen light or the X-ray, the nodules may be scraped with the Volkmann spoon, followed by the application of nitrate of silver in the solid stick. There is frequently a tendency to spontaneous recovery with the formation of a cicatrix. Compound syrup of hypophosphate, syrup hydriatic acid or some preparation of arsenic is usually indicated as a general tonic.

Rhino-Scleroma.—Rhino-scleroma is a chronic and progressive inflammation of the mucous membrane of the nose, extending to the external nose, lips, etc., and characterized by the formation of thick, nodular growths in the tissue.

Etiology.—According to Wolkowitsch, Chiari, Cornil and others, the disease is produced by the bacillus rhino-scleromatis. The bacillus grows upon blood serum and is stained with methyl-violet.

The affection is observed in "eastern Austria and south-western Russia. Isolated cases have been observed in Silesia, Italy, Egypt, Belgium, Sweden, Switzerland and Central America" (Ziegler). According to Dr. A. W. Brayton, one case has been observed by him in Indianapolis.

Pathology.—The disease is characterized by the formation of nodular thickenings on the nose and sometimes on the pharynx and larynx with ulceration of the mucous membrane. The growth resembles syphilitic granulation or granulating tissue and is yellowish or grayish in color. Bacilli are found between the cells. The infiltrated and ulcerated tissue may change into dense scar tissue, producing deformity of the organs involved.

Symptomatology.—The symptoms vary with the growth of the disease. There is little or no pain accompanying the disease. Nasal breathing may be interfered with as the growth extends backward

into the nasal cavity. In involvement of the larynx, there is difficulty in swallowing and impaired respiration from the dense cicatricial formations. In involvement of the lachrymal duct there is epiphora and conjunctival irritation. When the mouth is involved there is difficult speech and interference with ingestion of other than liquid food.

Diagnosis.—The disease is especially one of adult life and is characterized by the formation of thick nodular masses in the mucous membrane and skin. Microscopically, the disease resembles a granuloma and between the cells are found the bacillus, which resembles Friedländer's pneumococcus.

The disease should be differentiated from tuberculosis, syphilis or epithelioma.

Treatment.—Salicylic acid locally and by the mouth in ten grain doses is recommended by Lang. Operative treatment is of little avail as the disease has a tendency to recur. In obstruction of the larynx, operative measures may be necessary to prevent total stenosis and death.

Tuberculosis of the Nose.—Tuberculosis of the nose is characterized by the formation of neoplasms or ulceration of the mucous membrane and often accompanies a general pulmonic tuberculosis.

Etiology.—The disease is due to local injury of the parts, followed by infection from the tubercle bacilli from tubercular foci in some other part of the body.

Pathology.—The disease is due to the presence of tubercle bacilli, which produce a circumscribed ulceration, more often on the septum or floor of the nose, or a hyperplasia of the mucous membrane, which may be sessile or pedunculated and pale gray or slightly yellowish in color. Miliary nodules may sometimes be seen surrounding the ulcerated form. Microscopically a section of a tubercle neoplasm of the nose resembles the submiliary tubercle.

Symptomatology.—In the ulcerated form there is an accumulation of crusts which are blown from the nose. There may be more or less stoppage of the nose, perforation of the septum and nasal catarrh. In the neoplastic form, there is nasal obstruction and symptoms of hypertrophic catarrh.

Diagnosis.—With only a few exceptions, there is present a general or pulmonary tuberculosis. Tubercular ulcers are somewhat irregular in outline, have a characteristic yellow surface and are surrounded by apparently normal tissue. There is no deep necrosis of tissue and suppuration as in syphilitic ulcer or the ordinary infective ulcer. There is a tendency to bleed upon irritation with a probe. In the neoplastic form, small papillomatous growths may be seen attached to the septum, floor of the nose and turbinated bodies, and upon microscopical examination are found to contain tubercle bacilli. The location of the ulcer is reported to be more often observed in the order of their frequency upon the septum, the lower turbinate and the middle turbinate.

Prognosis.—On account of the general infection, the prognosis in regard to cure is unfavorable. Deformity following the disease is comparatively slight, and in consequence, the removal of the neoplasm and local treatment are favorable for the amelioration of the local irritation.

Treatment.—In the necrotic form of the disease the nose should be sprayed twice daily with a mild alkaline spray, followed by an oil spray containing acetozone.

Small papilla-like growths may be destroyed with the galvanocautery or removed with snare and scissors. It is advisable to refrain as far as possible from surgical procedure in the nasal cavity in a general tuberculosis.

The general treatment is directed to combating the tubercular infection by tonics, sunshine and out-door life.

Leprosy.—Leprosy is a chronic, contagious and infectious disease, and according to Isadore Dyer, usually originates in the nose and extends to the skin and internal viscera, producing great deformity of the entire body.

Etiology.—The disease is presumed to be due to the bacillus lepræ, a small bacillus resembling the tubercular bacilli, discovered by Hansen, in 1874, which requires a close and long contact between a healthy individual and a leprous one, for contagion to take place.

The disease occurs endemically in Asia, Africa, northern and southern Europe, North America, South America, and the Islands of

the Indian and Pacific Oceans. In the United States, the disease is quite prevalent in Louisiana, and isolated cases are not infrequently encountered in other states of the union.

Pathology.—The disease resembles, histologically, the granulomata of syphilis or tuberculosis. In the broken down connective tissue cells and the discharge from the ulcerated processes, the bacillus is found in profusion. Two varieties of the disease are recognized, lepra tuberosa, and lepra maculo-anesthetica.

Symptomatology.—The disease usually begins in the anterior nasal fossæ, and is characterized by a hyperæmia of the skin and mucous membrane, which are covered with irregular nodules, which gradually produce great deformity and sometimes nasal stenosis. With the extension of the swelling and internasal pressure, the mucous membrane becomes pale and anemic. The nodular eruption extends to the face and forehead and gradually to all parts of the body.

In the beginning of the disease, the discharge from the nose is thick and muco-purulent in character, but as the mucous membrane becomes hard and nodulated and deprived of nourishment, the secretion is very slight, sometimes forming thick scabs, from which a fetid odor escapes.

Fatty degeneration may now take place with the formation of sloughs and destructive ulcerations, resembling syphilis.

Diagnosis.—In those sections of the country in which the disease is prevalent, leprosy should be suspected when the above enumerated symptoms are detected in the nose. The ease with which the organism is detected in the nasal secretion should enable one to early diagnose the disease.

Various prodromal symptoms, extending over a long period of time, as chills, fever, general malaise, pain in the nose and forehead, epistaxis and motor and sensory disturbances should also call attention to the possibility of the disease. After the disease is well advanced, it is easily diagnosed and of comparatively little interest to the rhinologist.

The disease should not be confounded with rhino-scleroma, syphilis, fibromata, or lipomata.

Treatment.—The local treatment is directed to frequently cleansing

the nose with some alkaline, antiseptic solution, followed by the application of ichthyol or resorcin ointment. Adhesions between the septum and turbinals can sometimes be prevented by the use of Pynchon's splint.

According to Dyer, the general treatment consists in the hypodermic injection of 20–30 c.c. Calmette's antivenene into the intracapsular regions, every other day.

According to LePage, of Calcutta, chaulmoogra oil, in from five to ten drop doses, is highly recommended three times daily.

Thickenings about the nose, which may interfere with breathing, may be removed by surgical measures.

Epistaxis, or Hemorrhage from the Nose.—*Etiology.*—The causes of nasal hemorrhage are both predisposing and exciting.

D'Astros considers hereditary syphilis, with or without ulcers, as the most frequent cause of hemorrhage of the nose in children. Additional causes of epistaxis are ulceration of the mucous membrane from syphilis, tuberculosis, and infection, carcinoma, purpura hemorrhagica, purpura rheumatica, hemorrhagic diathesis, vicarious menstruation, plethoric habits, mountain climbing, chronic anemia, cardiac hypertrophy, valvular disease, Bright's disease, typhoid fever and malarial fever. Children at puberty frequently suffer from epistaxis. The condition may also be produced by necrosis of the accessory cavities, foreign bodies in the nose and the strain of whooping cough.

Among the exciting causes are injury of the epithelium from picking the nose, blow, fracture of the nose or fracture of the base. According to Phelps, in two hundred and eighty-six tabulated cases, hemorrhage from the nose occurred in one-fourth of all the cases of fracture of the base and especially was there hemorrhage in fracture of the anterior fossa and fracture of the anterior middle fossa.

Symptomatology and Diagnosis.—Hemorrhage from the nose may be so profuse and so prolonged as to produce exsanguination and syncope. The diagnosis of the exact origin of the hemorrhage is sometimes difficult. The blood may sometimes be seen spurting from the artery in septal hemorrhage. The nose should be sprayed or mopped with a four per cent. solution of cocain, followed by

1/1,000 adrenalin solution. Bood clots should be removed by blowing the nose. After free exposure of the nasal cavity, the site of the hemorrhage can be located. Hemorrhage may be from the lachrymal canal, as reported by Bookwalter, emptying itself into the inferior meatus and slightly posterior to the anterior tip of the lower turbinate. Hemorrhages from the anterior septum are easily located. The site of a hemorrhage originating in the posterior portion of the nose or accessory cavities is sometimes very difficult to locate.

Treatment.—Rest in bed and spraying the nose with adrenalin chlorid will, in the milder form, arrest hemorrhage. If the hemorrhage is from the exposed vessel on the septum the vessel should be lightly touched with chromic acid fused upon a probe. Touching with the galvano-cautery will have a like effect. When the hemorrhage is from the post-nasal space, deep packing with strips of bichlorid gauze soaked in albolene is indicated. The nasal gauze packer may be used to advantage in packing the cavity. Fluid extract of ergot in twenty drop doses every hour, with the patient sitting erect with head thrown back, will arrest hemorrhage in mild forms of epistaxis, supplemented by ice bags to the nape of the neck. The post-nasal space may be plugged by means of the Bellocq cannula or soft catheter. The plug itself should not be left in position longer than forty-eight hours for fear of septic infection. The plug, which should be made of sponge, cotton or lint, should be three-quarters of an inch long and one-half inch wide for adults and should be thoroughly sterilized before inserting. The catheter to which a strong aseptic string is attached, or the Bellocq cannula is passed along the floor of the nose into the pharynx, when the string from the cannula is brought forward through the mouth. If the movable rod which contains an eyelet in the cannula of Bellocq protruded into the mouth and can be threaded, the plug, oiled with carbol-vaselin, is drawn into position quickly but not too forcibly, for fear of destroying the normal epithelium. It should not be introduced too tightly for fear of causing sloughing of the mucous membrane and necrosis of the bone. If hemorrhage occurs after removal of the plug, the nares should be thoroughly cleansed before another is introduced to obviate danger of sepsis (Bryant).

Rhinoliths.—*Etiology.*—The condition is due to a foreign body finding lodgment and remaining in the nose for a long time.

Pathology.—As the result of the presence of a foreign body, the salts of the nasal secretion may collect about the foreign body as a nucleus. The progress of growth is necessarily very slow. The salts that go to make up rhinoliths are sodium chlorid, calcium phosphate and carbonate, magnesium phosphate and organic substances.

In addition to the progressive nasal stenosis, there may be pain in the nose and a profuse and sometimes offensive muco-purulent discharge from the anterior and posterior nares. Ulceration of the hard palate or septum may occur from pressure.

Diagnosis.—The nose is first sprayed with a four per cent. solution of cocain and adrenalin chlorid, 1/5,000, followed by cleansing with Dobell's solution.

Under good illumination, the calcareous deposit can be detected with a cotton-tipped probe. The condition may be confounded with necrosis of bone.

Treatment.—The treatment is essentially surgical and is directed to the mechanical removal of the foreign body. If small, the calcareous formation may be removed under local anesthesia, with a blunt hook or goose-neck forceps. Should the size of the growth preclude its removal in toto, it should be crushed with a lithotrite. The subsequent treatment is directed to keeping the nose clean with an alkaline and antiseptic solution. Ulcerations due to pressure should be touched at intervals with a ten to twenty per cent. solution of nitrate of silver and dusted with stearate of zinc.

Foreign Bodies.—*Symptoms and Diagnosis.*—Foreign bodies may be placed in the nose by young children, insane and hysterical individuals. The object may sometimes be detected in the anterior nares. There is usually a history of acute stenosis and more or less watery discharge from the nose. If the foreign body is of a character which swells from absorption of moisture, the patient complains of pain in the nose. An undetected foreign body in the nasal cavity, especially in young children, may bring about spasms, cough or purulent sinusitis.

Treatment.—Under good illumination and with a Bosworth nasal

forceps, the foreign body, if situated anteriorly, can usually be extracted with but little pain. If the foreign body is situated in the attic or middle portion of the nose, the mucosa should be anesthetized with a four per cent. solution of cocain, which produces shrinkage of the mucosa and free exposure of the nasal cavity. It is seldom necessary to resort to chloroform or ether narcosis for the extraction of foreign bodies from the nose.

CHAPTER XIX.

DISEASES OF THE NOSE (CONTINUED).—NEUROSIS OF THE NOSE AND NASAL FOSSÆ.

Neuroses of the nose and nasal fossæ are motor, sensory and reflex.

Motor Neurosis.—Motor disturbances of the nose are infrequent. The dilatatores nasi may, from syphilis and weakness due to imperfect breathing due to the presence of adenoids, become partially or completely paralyzed, causing a sudden collapse of the lateral membranous walls of the nose and interference with respiration. Twitching of the nose is due to irritation of the peripheral nerves, especially branches of the seventh nerve.

Sensory Neurosis.—Sensory disturbances are more often anosmia, hyperosmia, parosmia, disturbances of olfaction, anesthesia, hyperesthesia and paresthesia.

Anosmia.—Anosmia is a condition of complete loss of smell and may be congenital or acquired. The acquired form may be due to disease or injury of the olfactory nerve and may be central or peripheral. The condition may be associated with hysteria, meningitis, tabes, brain tumors and acute or chronic rhinitis, extensive ethmoidal neuroses, syphilis, fracture of the skull, collapse of the nose and influenza.

Hyperosmia.—Hyperosmia is an increased sensibility of the olfactory nerve. Odors and the ability to detect the same are intensified.

Parosmia.—Parosmia is a perversion of the sense of smell and may be associated with local or systemic disturbances, insanity and hysteria, and is classed as an aura of epilepsy.

Disturbance of Olfaction.—This is a lessening of the sense of smell and may be due to acute coryza, inflammation of the ethmoidal cells, systemic disturbances or operation within the nasal cavity.

Anesthesia.—Anesthesia is due to some irritation, obstruction

or paralysis of the trigeminal nerve. Tactile sense of the skin and mucous membrane is lost. Irritation, when applied to the mucous membrane of the nose, does not bring about sneezing or allied reflex disturbances.

HYPERESTHESIA.—Hyperesthesia is an over-sensitiveness of the branches of the trigeminal nerve and may be due to central or peripheral irritations. It is sometimes a purely psychic condition. The nasal mucosa is found to be over-sensitive to the slightest irritation.

PARESTHESIA.—Paresthesia is due to a general neurosis. The patient imagines the presence of foreign bodies and diseased areas of the nose. Affections of the nasal cavity may exist. The source of the irritation, however, is placed in some other portion of the nose.

Reflex Neurosis.—Reflex neuroses are irritations of the skin and mucous membrane of the nose, producing local and general disturbances. The three principal reflex neuroses are cough, sneezing and asthma.

Nasal cough is frequently observed in young children and adults who have acute or chronic thickening of the nasal mucosa.

According to Matheson, stammering is due to diseases of the nasal cavity, in most cases in early life.

Whether or not hay fever is purely a neurosis of nasal origin is yet to be determined.

Macewen reports a case of epilepsy, which was greatly relieved if not entirely cured by the removal of a large exostosis of the septum.

Hay Fever.—*Etiology.*—The causes of hay fever are both predisposing and exciting. The important predisposing cause of hay fever is idiosyncrasy, which is probably accentuated by malformation of the nose, uric acid diathesis, heredity, climatic conditions, social environments, enlarged turbinates, infection of the septum, spurs on the septum and sensitive areas of the mucosa.

According to Chas. P. Grayson, "Whatever we term this—lithemia, or the gouty or uric acid diathesis—is immaterial, the essential fact being that through intestinal toxemia or some disturbance of normal metabolism, there results a persistent poisoning of the blood current. At the very moment that contamination of the blood occurs,

there is inaugurated an increasing irritation and a steadily diminishing stability of the reflex nervous centers. The vaso-motor centers are early affected and when their loss of equilibrium is perhaps added to a long precedent nasal lesion that has rendered the pituitary mucous membrane particularly intolerant to any form of irritation, we have but to wait the floating of some variety of pollen into the nostrils to witness the speedy evolution of this disease."

The exciting cause is the pollen of the rag weed and the goldenrod, which is found floating in the atmosphere about the middle of August. This acts as an irritant to the mucosa upon being inhaled and brings about a condition known as hay fever.

Pathology.—The exact pathology of the disease is still undetermined. Since Hack proclaimed his theory of nasal reflexes numerous investigators have come to believe thoroughly in the neurotic origin of hay fever. The theory of John N. McKenzie is that the disease is a vaso-motor paresis due to some peripheral irritation. According to Shurley, recurrence of hay fever leads to hyperplasia of the turbinated bodies and other portions of the lining membrane of the nasal passages and thus constitutes the effect as well as the cause of the disease.

Sneezing is purely a reflex neurosis, produced by some irritation upon the anterior sensitive areas of the mucosa or the olfactory nerve, as shown by the sneezing produced by the odor of flowers, fruits, etc. Nasal reflexes may originate in the nose and end in the nose; originate in the nose and manifest themselves in other organs; or originate in other organs and affect the nose.

Symptomatology.—The disease makes its appearance about the middle of August and in the beginning is characterized by symptoms resembling an attack of acute coryza. The patient suffers from periodical attacks of sneezing, swelling of the mucous membrane of the nose, stenosis, prolific mucous discharge from the nose, sometimes photophobia and lachrymation. The patient frequently suffers from headache, constipation and slight elevation of temperature. The disease is frequently complicated with asthma. The disease continues until frost, which occurs about the middle of September and in northern climates much earlier. Upon examination, the nasal

mucosa during an attack is seen to be very edematous, whitish and covered with clear glistening mucus. The lower turbinates are frequently hypertrophied and impinge upon the septum. During the intervals of the attack the condition of the mucous membrane of the nose varies from that observed in chronic hypertrophic catarrh, to that resembling hyperplasia or sclerosis.

Diagnosis.—Diagnosis of hay fever is comparatively easy. Rose cold resembles hay fever and is a hyperesthesia of the mucosa, occurring in the month of June, the exciting cause of which is odor or dust of roses.

Treatment.—The treatment is both local and constitutional. The constitutional treatment should be directed to the correction of irregularities in the habits of the patient, such as indiscretions in diet, alcoholic, narcotic and sexual indulgences.

According to the investigations of D. Braden Kyle, local irritations are due to chronic changes in the constituents of secretion from the mucous glands and in many cases he found sulpho-cyanids and ammonium salts in the nasal secretion.

Kyle reports that by rapidly changing the character of the secretions either from an acid to an alkaline or from an alkaline to an acid, neutralizing the secretions, he was enabled to relieve eighty or ninety per cent. of all the cases treated.

Professor Dunbar, of Hamburg, believes the disease to be due to a specific poison found in the pollens of rye, barley, wheat, and other granous substances and with this in mind, has given to the profession an antitoxin which is presumed not only to immunize the patient against pollen toxins, but will palliate the symptoms of the disease during its cycle of activity.

The method of immunization consists in using the serum antitoxin or powdered pollantin after the directions of Professor Dunbar. The serum antitoxin is obtained by the inoculation of horses with the toxin obtained from the albumenoid body found in the starch particles of pollen granules and the serum from the horse is dispensed in small phials provided with a dropping pipette. The directions for its use are as follows:

"Bring, by means of the pipette, one drop to the outer angle of the

eye, and, drawing down the lower lid with the finger, allow the drop to come in contact with the mucous membrane. A pleasantly cool sensation felt in the eye shows that the instillation has been properly carried out.

"With the head bent somewhat backward, insert the point of the pipette about half an inch into each nostril and express one or two drops of pollantin into each. Care must be taken to keep the pipette squeezed as long as it is in the nose, otherwise the pollantin will be drawn back into the pipette again. After pollantin has been introduced into one nostril, the other must be kept closed, while the serum is sniffed up from the one treated, tapping the while on the outside of the nostril, with the finger."

The directions for the use of powdered pollantin are as follows:

"Fill about one-fourth of the little scoop inserted into the cork of the serum-containing tube with the powdered pollantin. Holding this under one nostril sniff the powder up, keeping the other nostril closed. The powder will be better distributed over the interior of the nose if, while sniffing, the outside of the nostril treated be lightly tapped.

"Those patients who wish to use powdered pollantin for the treatment of the eyes should dip the accompanying camel-hair brush into the powder and brush it along the inner surface of the lower eyelid previously drawn down by the finger."

The general directions for the use of the powder or serum are as follows:

"Hay fever patients ought to sleep with closed windows during the hay fever season.

"Pollantin should be used, both for eyes and nose, regularly every morning, a few minutes before rising. Should it cause sneezing or reddening of the mucous membrane of the eye, the preparation should be again used after a lapse of one or two minutes, and if the sneezing or the reddening of the eye does not then disappear the instillation should be repeated a third or even a fourth time.

"By this morning-treatment the patient will generally find himself insensitive to the hay fever poison for several hours, often, indeed, for the whole day.

"Those patients who are unable to keep themselves completely free from attacks—even when they begin the serum treatment before the commencement of the hay fever season, always sleep with windows closed, and regularly carry out the above described morning-treatment—are recommended to carry pollantin always about them. They should use the serum during the course of the day whenever there is the slightest sign of irritation, and not wait until a sharp nasal attack sets in, when the nose becomes so swollen and blocked that pollantin cannot be efficiently applied, nor probably absorbed from the altered mucous membrane.

"If the use of pollantin at the correct time, as described, has been neglected, the serum may sometimes still be used with benefit in the early stages of the attack, stopping the burning in the eyes, the excessive flow of tears and sneezing. Should, however, the hay fever poison have entered the body in such amounts that the eyes have become strongly inflamed and the nose swollen and blocked with secretion, or that asthma has appeared, then the patient should retire to rooms with doors and windows closed, and remain there until all these symptoms have disappeared. By using instillations of pollantin, at first every ten minutes, and later at longer intervals, this process can be accelerated. When the patient's condition is once more restored to the normal he should endeavor to prevent any further attack by the careful use of the serum as above described."

In addition, the general local treatment is directed to overcoming the idiosyncrasies of the disease and special attention is directed to the intestinal canal and emunctories of the body. Physical exercise is especially indicated. When uric acid anemia exists, Bishop recommends carbonate and citrate of lithium, as well as a preparation of sodium and potassium of magnesium, 10–15–20 grains of lithium is given in water morning and evening. Five and ten grains of sodium and potassium of magnesia are to be administered in the same doses.

The diet of the patient should consist of milk, fish, white meats, bacon, cereals, vegetables, etc. Roast beef, coffee, tea, alcoholic liquors, steaks and all those foods and drinks which tend to increase the uric acid condition, should be dispensed with.

The surgical treatment consists in the removal of any spurs or hypertrophies of the middle or inferior turbinated bones and the destruction with the galvano-cautery of any sensitive areas in the nose. Cauterization of the septum has been highly recommended by a number of writers, followed by dusting the nasal cavity and the antrum with aristol, through its natural opening by means of a cannula, as recommended by Fink. The application is made daily, for three days, after which the attack becomes rapidly lessened in intensity.

Change of climate usually brings about the most satisfactory and earliest alleviation of the distressing symptoms of the disease. Hay fever patients in the United States find speedy relief from a sojourn in the White Moutains, northern Michigan or an ocean voyage. The intensity of the disease varies somewhat according to the seasons. Patients who suffer from the distressing nervous symptoms of the disease should resort to climatic change before the disease has made its onset. Patients frequently trust to Providence to relieve them of the harrowing symptoms and in consequence of misplaced confidence, distressing nervous symptoms often manifest themselves, which incapacitate the patient for active duties for a very long time after all the symptoms of the disease have passed away.

Asthma.—*Etiology.*—The causes of asthma may be congenital or acquired, predisposing and exciting.

The underlying cause is probably a peculiar irritability of the mucous membrane and constriction of the muscles of the bronchi, bronchioles and diaphragm associated with a like condition of the nervous system. The disease has been observed in children as young as three or four months and may be associated with enlarged tonsils and adenoids. In young children, the disease is sometimes induced by indigestion and hysteria.

Asthma and hay fever are frequently closely allied and the same cause may produce the two conditions. The asthmatic attack may continue only during the course of the hay fever and remain latent during the remainder of the year. In many hay fever patients, asthma continues in a mild form during the whole of the year and is accentuated by climatic conditions. seasons, emotional excitement,

pelvic diseases in women, nasal irritation from polypi or hypertrophic nasal catarrh.

Pathology.—The pathology of the disease is somewhat obscure. The mucous membrane of the bronchi is swollen and covered with a mucous exudate. Upon post-mortem examination in uncomplicated asthma, nothing is discernible to indicate the morphology of the disease. In chronic asthma the mucous membrane may be hyperplastic or atrophic and when atrophic, emphysema may complicate the disease.

Symptomatology.—The disease more often comes on during the night and less frequently during the day. The symptoms vary according to the severity of the disease and may come on suddenly or be preceded by prodromal symptoms. There is a sensation of restriction of the lungs and inability to breathe, which ends in profound dyspnea. The patient sits up in bed or rushes to the window for breath. There are intense nervous depression, cyanosis, wheezing rales and cold extremities. The spasm may last for a few minutes to a number of hours or days.

Diagnosis.—There is seldom any difficulty in differentiating asthma from acute pulmonary edema or valvular heart disease. If due to irritation of the nose, under cocain anesthesia the symptoms will be distinctly ameliorated. If polypi, nasal hypertrophies, sinus disease, adenoids and hypertrophied tonsils are present, especially in children, one is justified in believing them to be contributing causes. Only by a process of exclusion can we differentiate between nervous asthma and asthma from local or systemic disturbances.

Prognosis.—If due to adenoids or hypertrophied tonsils, in children, a cure or distinct relief of all symptoms speedily results from operative measures. If the disease is brought under treatment early and the predisposing cause is removed, the patient may go through life with only mild relapses of the disease. If the cause is located and removed, recovery may be complete. As a rule, the disease is chronic and susceptible to frequent accentuations.

Treatment.—Hot applications to the chest and extremities are indicated. Internally, tincture of lobelia, ten to thirty min., or extract grindelia robusta, two to ten min., may be given.

The nasal cavity should be sprayed with a four per cent. solution of cocain. In violent spasms, it is necessary to give chloroform, which may be inhaled, or morphia, hypodermatically. Stramonium leaves mixed with saltpetre may be burned in a plate and the fumes inhaled. Iodid of potassium combined with bromid of potassium is highly efficacious during the attack and in the interval of the disease.

Change of climate frequently brings about a quick amelioration of all the symptoms. If the disease is dependent upon hay fever the symptoms may pass away with the relief of the nasal irritation. Suspected irritation of the nose from hypertrophies, etc., amenable to surgical treatment, adenoids and hypertrophied tonsils, especially in asthmatic children, should be removed. Gastro-intestinal and pelvic disorders should be relieved.

According to Bullawa and Kaplan, Montefiore Home, adrenalin chlorid hypodermatically in from six to ten drop doses will relieve the asthmatic attacks in the majority of cases. Smaller doses may be given and repeated in a short time if necessary. In a few cases, severe rigors may come on after the administration of adrenalin chlorid. The drug should be given hypodermatically and not by the mouth. A four per cent. solution of menthol and chloratone in alboline, as a deep inhalent, is frequently very efficacious in controlling the bronchial spasm.

CHAPTER XX.

DISEASES OF THE NOSE (CONTINUED).

Myxomata or Nasal Polypi.—Nasal polypi are pedunculated and jelly-like masses usually springing from some localized area or necrosis in the bony structure of the nose. They may be single or multiple in number.

Etiology.—The cause of nasal polypus is somewhat a matter of dispute. The two important factors in the etiology of the disease are extrinsic irritations or irritations applied to the mucous membrane, and instrinsic irritation or irritation beneath the epithelium.

Woakes believed the condition to be due to a chronic nasal catarrh with localized caries of bone from which might spring layers of connective tissue cells; this distending becomes the enveloping membrane of the polypus.

The theory of a number of investigators is, that the polypi are due to some previous inflammation of the mucous membrane which results in a budding and subsequent infiltration with mucin, a liquid-like substance.

Mucous polypi more often spring from the region of the middle turbinate (two-thirds, according to Zuckerkandl) and at a point exposed to the irritation produced from any inflammation or suppuration in the frontal or ethmoidal cells. Irritation from chronic inflammation in the ethmoid region must be classed as the important factor in the causation of the disease.

Pathology.—The condition is probably one of edema and stretching of the mucous membrane from an accumulation of a gelatinous intercellular substance, containing mucin, a substance freely secreted by the mucous glands of the nose and is probably due to a primary affection of the underlying periosteum. The change in the bony structure is necessarily variable, and may be a typical form of

rarefying osteitis or periosteitis. The structure of a mucous polypus varies according to the localized necrosis and blood stasis in and about the tumor and may contain fibrous connective tissue or broken-down epithelial cells, debris and pus cells.

Polypi do not change into malignant tumors. Billroth, however, discovered that a malignant tumor could spring from a mucous gland of a polypus.

Symptomatology.—The patient complains of frequent attacks of cold in the head, nasal shortness of breath, sneezing, droppings in the throat, headache, otophonia, loss of smell and general debility. One or both sides of the nose may be affected.

Polypi may be the exciting cause of frequent attacks of sneezing, rhinitis, hay fever, bronchitis and asthma.

Malignant growths of the nose and accessory cavities may be produced by irritation due to the presence of polypi. Frequently malignant tumors of the nose accompany nasal polypi, independent of the polypi.

Diagnosis.—The presence of polypi in the nose, especially when located near the anterior middle turbinate, is comparatively easy. They appear as pale adenoidal bodies, covered at times with thick mucus. Following cocainization of the nasal cavity, the tumor can be moved about and is observed to be pedunculated. Polypi situated posteriorly and in the middle meatus are sometimes very difficult to discover and are frequently overlooked until the turbinate is removed. Small polypi may so contract from the application of cocain as to escape early detection.

The disease is more often observed in men than in women and after adult life.

Treatment.—The treatment is essentially surgical and consists in the complete extirpation of the tumor, and frequently the removal of the middle turbinate and curettement of the ethmoid sinuses. For snaring polypi from the nose, the Wright's snare (Fig. 116) is one that can be manipulated with great freedom. The nasal cavity should be sprayed with a five per cent. solution of cocain, followed by the application of adrenalin 1/5,000. The anesthetic should be applied as far as possible about the pedicle of the tumor with a

cotton-tipped probe under good illumination. After anesthesia is complete the nose should be irrigated with a normal salt solution or Dobell's solution.

The loop of the snare is passed about the tumor and pushed to its attachment by a rocking motion of the hand. While the loop is being passed into position, it should be gradually reduced in size. In a very large polypus, it may be necessary to grasp the base of the growth with a hook or goose-neck forceps previously passed through

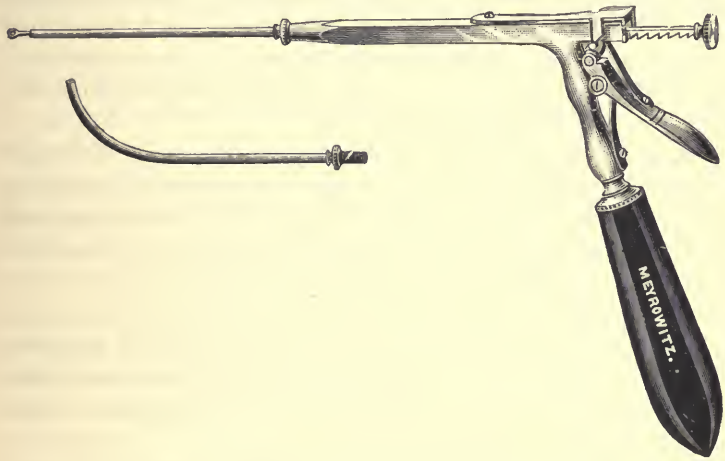

FIG. 116.—WRIGHT'S SNARE.

the wire loop. With its base in position, the wire is pushed home. It is frequently impossible, on account of the hemorrhage, which may obscure the field, exhaust the patient, etc., to remove all of the growth that may be in the nose, at one sitting. Hemorrhage following the removal of the polypus is, as a rule, inconsequential. Following the removol of polypus, the nasal cavity should be irrigated with a warm antiseptic and alkaline fluid and dusted with stearate of zinc (see method of removing the middle turbinate).

Necrotic areas of bone should be curetted. If there is present a chronic, purulent ethmoiditis with necrosis of the walls, the sinuses should be opened and curetted. The nasal cavity should be inspected

a few weeks following the removal of all polypi, for evidence of new growths.

Papillomata.—Papillomata are wart-like growths springing from the skin or mucous membrane. Those springing from the mucous membrane are known as soft papillomata, while those from the skin or junction of the skin and mucous membrane about the nasal orifices, are known as hard papillomata.

Etiology.—Syphilis is probably as very important factor in the etiology of the disease. The disease should be attributed to some form of irritation, extrinsic or intrinsic.

Pathology.—The disease is probably one of proliferation and hypertrophy of the papillæ of the skin or mucous membrane (see Pathology of Papilloma).

Diagnosis.—The disease is usually easily diagnosed. The tumor may appear somewhat paler than the surrounding tissue and variable in outline. The wart-like condition of the tumor is detected with a blunt-pointed probe. In four cases observed by the author, the tumors were more often located on the anterior septum.

Prognosis.—Provided the growth is all removed, the prognosis is good in regard to recovery. It is sometimes difficult to remove all the growth at one time if the growth is situated posteriorly along the floor of the nose. In consequence, a second operation is sometimes necessary.

Treatment.—If large enough, the growth should be snared, followed by the application of chromic acid. When situated upon the septum, the growth will be more easily removed with scissors. Hemorrhage follows the operation and is especially profuse when the tumor has a broad base.

Adenomata.—Adenomata are tumors composed of new-formed gland tissue, occurring in the skin or mucous membrane covering the nose or nasal orifice.

Etiology and Pathology.—The pathology of adenomata of the nose is the same as that of adenomata of any other portion of the body, as the breast, kidney and liver, and is referred to under Pathology of Adenoma.

Diagnosis.—The disease may occur at any age and is observed

to be a non-vascular, grayish-white tumor, nodular in character. Upon microscopical examination, the coils of ducts can be detected.

Treatment.—The treatment consists in incision under antiseptic precautions, evacuation and curettement of the sac surrounding the tumor.

Angiomata.—Angiomata are vascular tumors, which occur infrequently in the nose.

Etiology and Pathology.—(See Pathology of Angioma.)

Symptomatology.—Angiomata of the nasal cavity may give rise to nasal obstruction and sensations of fullness in the nose. They sometimes ulcerate and produce violent hemorrhage. If the growth is very small, there may be little or no irritation from its presence. During an attack of acute coryza, the tumor is inclined to become distended.

Diagnosis.—On account of the structure of angiomata, which are composed largely of dilated blood vessels, the diagnosis is comparatively easy. Capillary angiomata or nevi are usually congenital or come on soon after birth and are easily differentiated.

Treatment.—Angiomata of the skin or mucous membrane should be removed as soon as detected. If the growth is small it may be punctured with an electric cautery. If too large to be destroyed with a cautery, the tumor should be snared and the nose packed with gauze.

Capillary angiomata are more easily destroyed with a cautery or by electrolysis, the negative pole being inserted into the growth and the positive held in the hand or at the nape of the neck. The port wine and claret stains are usually too extensive to be destroyed with local treatment, and excision cannot be practiced on account of the destruction of tissue and the marked cicatricial change which necessarily follows.

Fibromata.—Fibromata are tumors composed of bundles of fibrinous tissue having their origin in the sub-mucosa. They may occur at any age, but more often in young adults. They are closely allied with sarcoma and sometimes change into sarcomatous growths. They may also undergo calcareous, cystic or osseous degeneration.

Dr. Keene reports a case of soft fibroma of the skin covering the

nose with a distention of the acini and possibly hyperplasia of the sebaceous glands.

Fibromata are frequently found in the nasal pharynx and have a large sessile or pedunculated base.

Symptomatology and Diagnosis.—There is usually more or less obstruction of the nasal passages, and if the growth is located in the post-nasal space, the patient evinces symptoms of adenoid growths. There is little or no pain accompanying the disease. A soft or hard tumor, regular in outline, may be detected upon inspection, extending from the turbinated bodies and filling the post-nasal space, attaching itself to the mucosa covering the sphenoidal bone.

Microscopical examination of a section of the tumor is necessary for differential diagnosis.

Treatment.—A pedunculated fibroma of the nose and nasal pharynx may be removed with a snare or curved biting forceps, which is introduced through the nose or behind the soft palate. It is sometimes necessary to guide the loop of the snare into position with the finger passed in behind the soft palate.

Harmon Smith reports the cure of a naso-fibroma by the injection of three drops of mono-chloracetic acid at an interval of from two weeks to two months. There was but little reaction from each injection and the successive sloughs formed, finally removed the disease.

There is always more or less danger in the removal of a sessile fibroma from the nose, especially where the growth involves the bony structures and fracture of the ethmoidal and sphenoidal bone. Hemorrhage, convulsions and death may follow. Removal with the snare is very unsatisfactory where the base of the growth is very broad.

According to Jacobson and Steward, in operations in which there is involvement of bone, three methods may be pursued:

(*a*) Those in which the attack is made through the mouth.

(*b*) Those in which the attack is made through the nose.

(*c*) Those in which the attack is made by removing the upper jaw, partially or completely, or by resecting this bone osteoplastically.

The operation for the removal of naso-pharyngeal fibromata through the mouth, according to Jacobson and Steward, consists "in splitting the uvula and soft palate exactly in the middle line from before backward, then prolonging this incision along the center of the posterior half of the hard palate, going here down to the bone; from the end of this incision two others are made slightly obliquely downwards toward the teeth, also going down to the bone. The flaps, together with the periosteum, are then detached, so as to form nearly rectangular flaps. Two large holes are next drilled through the hard palate, each well to one side of the middle line, the intervening bone is cut away by placing the ends of cutting pliers in each of these holes, and, by making lateral cuts back to the free border of the hard palate, a rectangular portion of the posterior half of the bony vault is removed. The mucous membrane and the periosteum on the upper surface of the bone, which will now be found detached, are divided, and, if it be needful to get more room, more or less of the vomer is cut away. Room being thus obtained, the fibroma is removed and its attachment dealt with. If all the growth is taken away satisfactorily, the palate flaps are united in the ordinary way; if further treatment is necessary, staphylorrhaphy must be performed later."

Where the operation is made through the nose or naso-pharynx, one of the classical operations described by Lawrence, Ollier and Langenbeck, may be used.

The Lawrence operation consists in making a curved incision extending from the inner canthus down to the alæ of the nose and upward to the opposite inner canthus. The nasal bone and the nasal process of the superior maxillæ and nasal septum are separated with strong scissors. The separated mass is turned upward and the nasal cavity exposed for any further operative procedure.

The Ollier method is a reversal of the Lawrence operation: The nasal bone and nasal process of the superior maxillæ are sawed through in the line of the incision, thus allowing the nose to turn downward. If it is impossible to saw through the nose in the line of incision, a small hole may be bored through the nasal bone and the saw inserted for the completion of the bony incision.

The Langenbeck operation consists in making an incision through the inner edge of the eyebrow, along the bridge of the nose to the cartilaginous portion of the nose, when the incision is curved backward to the junction of the alæ of the nose and cheek. The nasal cartilage dissects loose, with a fine saw inserted at the separation

FIG. 117.—OLLIER'S OPERATION. (After *Esmarch, Kowalzig, Jacobson and Steward.*)

of the cartilage from the bone, the nasal process is sawed through up to the lachrymal sac. The incision is carried forward to the bridge of the nose and is again directed downward through the nasal bone at the junction of the septum and nasal bone. A small particle of bone is easily removed with forceps and scissors. Removal of neoplasms or partial or complete removal of the superior maxillary bone is described under carcinoma of the maxillary antrum.

The operation for the complete removal of the maxillary bone is indicated where the fibrinous growth has become very extensive and involves the nasal bone and sinuses of one or both sides of the head.

The question of preliminary laryngotomy is one that must be left to the operator, especially in the removal of the superior maxillary bone.

Where the operation is performed through the mouth, preliminary laryngotomy is indicated.

In the Lawrence and Ollier operation, the question of preliminary laryngotomy is necessarily dependent upon the size of the growth to be removed. If the growth does not extend into the nasal pharynx plugging the post-nasal space may be performed.

The same rules of operative procedure for the removal of fibromata may apply to the removal of malignant neoplasms.

Chondromata or Enchondromata.—Chondromata or enchondromata are tumors made up of hyaline cartilage, fibro-cartilage or a combination of the two. Their origin is more often on the septum of the nose. Tumors of this character possess an adherent capsule.

Diagnosis.—The size of the chondromata varies and may be small or of large dimensions, sometimes undergoing cystic degeneration. In the early stages of the growth of the tumors they are hard and immovable.

Chondromata may occur at any age and sometimes change into sarcomata. Unless the growth is entirely removed, recurrence takes place. If the growth cannot be removed through the nose, the Lawrence or Ollier operation is indicated.

Treatment.—Complete removal of the growth and its capsule by excision is early indicated on account of the tendency to change into sarcoma.

Lipomata.—Lipomata involve the tip and sides of the nose and are composed of adipose tissue. They may be soft or hard, nodular or lobulated, and may be observed at any age. Like other benign growths, they rarely produce metastasis.

Diagnosis.—The diagnosis of lipoma is comparatively easy. The peculiar lobulated or nodular structure of the tumor, which is situated about the orifice of the nose, producing increase in size and marked deformity of the nose, suggests the diagnosis without the aid of microscopical section.

Prognosis.—As far as life is concerned, the prognosis is favorable. However, the growth may attain quite a size and interfere with respiration. Degeneration and sloughing of the tumor may take place.

Treatment.—The treatment is purely surgical and consists in partial or complete removal of the tumor.

Ostiomata.—Ostiomata are bony tumors which may have their origin in the bony or cartilaginous portion of the nose and may extend into the nasal cavity or backward, producing deformity.

Tumors of this character may have their origin within the sinuses or press into the nasal cavity or outward into the orbit, displacing the eyeball. The growth is usually self-limited. The tumor may be cancellous or compacted, and is usually fixed by a firm, hard base.

Symptomatology and Diagnosis.—The symptoms are those of nasal obstruction and painful pressure. The disease usually occurs in those past middle age, though it may be observed at any age. The disease should not be confined to exostosis.

Treatment.—If the pressure and pain are very great from the tumor, removal is indicated by means of a chisel, saw or bur. It may only be necessary to remove that portion of the tumor which produces pressure.

Malignant Neoplasms.—Malignant neoplasms of the nose (see Pathology, page 92) are divided into carcinomata and sarcomata. There is a tendency to give off secondary or metastatic growths and a disposition to recur after removal. The location of malignant growths of the nose is extremely variable and may be the accessory sinuses, bony structure, mucous membrane or external nose. They may take their origin within the nose and extend to contiguous parts and involve the nasal cavity as a result of metastasis or extension.

Diagnosis.—The disease may be taken for tuberculosis, syphilis, rhino-scleroma or a non-malignant tumor. A microscopical section should be made of a suspected malignant tumor as early as possible. If there is any reason to presume the presence of syphilis, heroic doses of iodid of potassium should be prescribed. Should the disease react to the iodid of potassium, the diagnosis of syphilis is at once manifested.

In carcinoma and sarcoma, there are nasal stenosis and frequent hemorrhages from the nasal cavity. The patient complains of pain, especially in sarcoma, which is of a deep boring nature. If the malignant growth involves the sinuses, the pain becomes so severe as to demand hypodermics of morphia for its alleviation.

Course and Prognosis.—The course of the disease is usually very rapid and unless interfered with by operative measures, as a rule, ends in death in from six months to two years.

The prognosis is variable. If the disease is removed early and

before infiltration of the lymph glands as in carcinoma or involvement of the sheath of the blood vessels extending into contiguous parts as in sarcoma, the disease may be cut short by operative measures. Unless all the tumor is removed, the disease will recur. There is always a tendency to metastatic spread of the disease.

Treatment.—John E. Rhodes (*Annals of Otology, Rhinology and Laryngology*, Sept., 1906) reports favorable results in the treatment of sarcoma of the nose with repeated injections of five drops of the following:

℞	Adrenalin Chlorid,	.12 c.c.
	Acid boracic,	.60 gm.
	Chloretone,	.025 gm.
	Aq. distillate,	15.00 c.c.

The good results may be accounted for by the theory of starvation. If the tumor is confined to the deeper structures of the nose, the treatment is surgical and the operation of Langenbeck, Ollier or Lawrence is indicated for its removal. Radium is highly recommended for the mitigation of pain. A small tube containing the radium should be passed into the nasal cavity and allowed to remain from five to ten minutes, every two or three days.

Epitheliomata of the external nose is frequently relieved and sometimes cured by the X-ray. Upon failure of the X-ray to cure the disease, the tumor should be incised and the plastic operation performed for the restoration of the symmetry of the nose.

Erysipelas.—*Etiology.*—The predisposing causes of erysipelas are trauma-producing excoriations or rupture of the cutis or mucous membrane and a predisposition of the system to infection. Dr. James C. White, in a discussion before the American Dermatological Association, 1904, is reported to have "referred to the frequency with which erysipelas has its origin in the nasal cavity, being usually due to the habit of forcibly removing scabs and crusts from the mucous membrane of the nose. He expressed the opinion that a large number of cases of erysipelas of the face was due to this habit, which affords the germs of the disease a ready means of entrance. He could recall perhaps twenty instances where persons, who had

long been subject to recurrent attacks of facial erysipelas, were permanently relieved by having their attention called to this habit and refraining from it in the future."

The exciting cause of the disease is infection from the streptococcus of Fehleisen, an organism identical with the streptococcus pyogenes.

Pathology.—The streptococcus of Fehleisen gains entrance through the cutis or epithelium of the mucosa from some solution of continuity, producing dilation of the blood and lymph vessels, with a serous exudation, peculiar redness of the parts and swelling. The disease may invade the deeper structures, producing a cellulitis. Toxins are eliminated, which bring about elevation of the temperature and general disturbances.

Symptomatology.—The period of incubation is from three to eight days. The onset of the disease is usually marked by a chill or chilly sensation, followed by a rise of temperature and sometimes vomiting. In the old, there may be general prostration and sometimes delirium.

Soon after the manifestation of the general symptoms, a small red spot is observed at the site of the previous injury, which may be in the muco-cutaneous juncture, mucous membrane, alæ, side or bridge of the nose, which rapidly extends to the surrounding cutaneous structures or backward into the nasal cavity. All the edges of the inflamed area are marked and the parts are red, swollen and infiltrated. In involvement of the mucous membrane, the redness is of a deep hue, and distinct from the surrounding mucous membrane. The pharyngeal wall, soft palate and uvula may be involved at the same time.

Diagnosis.—History of injury, sudden onset of the disease, high fever and circumscribed redness and infiltration of the mucous or cutaneous structures, with frequently extension to the eyelids and face, render the diagnosis easy.

Treatment.—The treatment is both local and general. The general treatment is directed to the gastro-intestinal tract. Calomel should be given in one-fourth grain doses every three or four hours, until free purgation of the bowels is secured. Perchlorid of iron in twenty drop doses or Blaud's pills should be given every three

hours. It is better to isolate the patient with confinement to bed. In the old, especially where there is great lowering of the vitality and cardiac lesions, strychnia and whisky are usually indicated.

If there is involvement of the mucous membrane, the local treatment consists in spraying the nose and throat with warm Dobell's solution, every hour. The nose and throat may be sprayed with a five per cent. solution of cocain for the relief of the burning and smarting. Upon detection, in phlegmonous inflammation in the soft palate or uvula, the same should be incised and drained. A ten per cent. solution of ichthyol may be applied to the mucous membrane of the nose upon a cotton-tipped probe, three or four times daily. The local treatment in inflammation of the cutis consists in painting the surface with pure carbolic acid and neutralizing, after the surface becomes white, with absolute alcohol. Ichthyol in fifty per cent. solution is highly recommended as a topical application. This may be painted over the surface with a camel-hair brush or cotton-tipped probe. Phlegmonous abscesses should be incised and irrigated twice daily with warm lysol solution, one drachm to the quart of water and dressed with bichlorid or iodoform gauze. Elevated temperature should be treated by cold sponge baths. Cold applications are contraindicated.

Furuncle.—*Etiology and Pathology.*—The cause of furuncle is some form of traumatism, followed by infection with the staphylococcus, which enters through the hair follicle. The predisposing causes of furuncle or boil, are lowered vitality, diabetes and picking the nose with infected fingers. Following the infection, a necrotic mass or "core" forms, which is composed of necrotic connective tissue, leucocytes and the infecting bacteria. Two or more follicles may become affected or the disease may spread and thus produce a very large area of necrosis. If superficial and a mild infection only occurs, a pustule is formed.

Symptomatology and Diagnosis.—A boil is usually located on the tip of the nose and from the rapid swelling, circumscribed induration, intense redness, throbbing and beating pain, is easily differentiated. The disease ends by rupture, by absorption or by evacuation of the core.

Treatment.—The treatment is prophylactic and curative. On account of the tendency of the disease to spread and recur, some form of prophylaxis is indicated and usually consists of mild purges, tonics and administration of three to six grains of calcium sulphid, three times daily.

The local treatment consists in frequent applications of camphophenique and poultices of antiphlogistin.

If the furuncle is located within the vestibule, the hair of the affected follicle should be extracted. If located externally, sometimes freezing for a few seconds with ethyl chlorid will assist in aborting the disease. Puncturing the follicle with a sharp bistoury or paracentesis knife sufficiently to cause free hemorrhage is very efficacious in many cases in relieving pain and may aid in aborting the attack. After pus is formed, a free incision should be made with evacuation of the core, followed by antiseptic dressing. The patient should avoid picking the nose for fear of carrying infection to some other section of the body.

Deformity of the Nose.—Deformity of the nose may be congenital or may result from blow, fall upon the nose, fracture or ulcer. For cosmetic reasons, some form of operative procedure is often necessary. In addition to the correction of saddle and pug nose by paraffin injection (page 136), it may be necessary to employ some form of artificial bridge for the restoration of the nose. The artificial devices designed by Martin and Weir, known respectively as Martins saddle and Weir's platinum bridge may be used. The bridge (Fig. 118) may be inserted by doing the Rouge operation, which consists in making an incision in the gingivo-labial fold from the first molar tooth to the first molar tooth on the opposite side, lifting the lip up and dissecting upward until the nasal passage is exposed. Holes should be drilled in the upper maxilla for the implantation of the legs of the bridge. With the bridge in position, the nose is replaced and the lip stitched into its original position. The subsequent treatment consists in keeping the patient quiet for a few days and cold applications to the nose for twenty-four hours following the operation. The nasal cavity should be irrigated twice daily with Dobell's solution, until the exposed surfaces have completely healed.

Angular deformities or bony humps are more often removed for cosmetic effects. In the operation designed by Roe, the surgeon enters the nose through the meatus and exposes the nasal bone by making an incision at the junction of the nasal bone and lateral cartilages elevating the skin and soft tissues and chiseling and sawing away of sufficient bone to correct the deformity. The bony hump

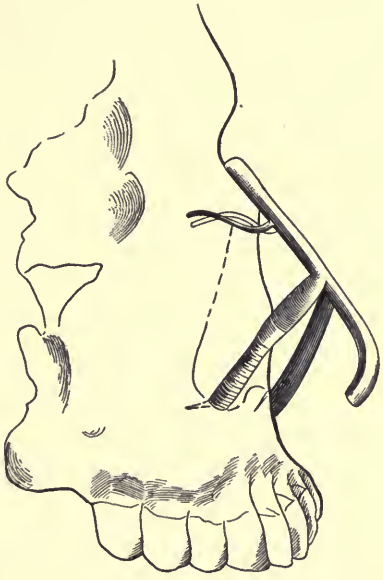

FIG. 118.—MARTIN'S BRIDGE IN POSITION.

may also be removed by making the incision through the skin of one side of the nose, elevating the tissue and removing the deformity with chisel and saw.

Fracture.—The bones involved in fracture of the nose are nasal bones, cartilaginous and osseous septum, nasal process of the superior maxillary bone, ethmoid and sphenoid bones (see Fracture of the Base).

Etiology.—Fracture is usually due to some form of traumatism and is more often due to a fall upon the face or blow upon the face

or head. Fracture may also be due to gunshot, contra-coup, and irradiation. Fractures may be depressed, simple, compound or comminuted.

Fracture of the vomer is a condition which may accompany fracture of the cartilage and, on account of its location, is overlooked in the greater number of cases.

Symptomatology and Diagnosis.—In fractures of the nasal bone and septum, there is pain, swelling and deformity. In fracture of the nasal bone, with gentle movement of the bridge of the nose, the diagnosis is easily established by crepitation.

Under good illumination, if the septum is involved, it will be bowed or turned. The usual site of the fracture of the septum is the anterior portion of the bony septum or the posterior portion of the cartilaginous septum. In a great many cases of fracture of the nose, either simple or compound, infection may occur, ending in the formation of an abscess and necrosis.

Fracture of the ethmoid bone may follow blow or fall upon the head and face. Symptoms of fracture of the ethmoid are profuse bleeding of the nose, loss of smell, puffiness of the conjunctiva and pain upon pressure in the inner sockets of the eye.

In fracture of the sphenoidal bone there may be sudden loss of sight, pressure upon the optic nerve, paralysis of the motor oculi, pain in the back of the eyes and hemorrhage from the nose. The temperature is slightly above normal. Meningitis may follow fracture of the ethmoid and sphenoid bones.

Treatment.—In fracture of the nasal bone or septum, the nasal mucosa should be anesthetized with a five per cent. solution of cocain, followed by irrigation with a mild antiseptic solution and examination under good illumination for deviations, foreign bodies and spicula of bone.

With a rose elevator, depressed nasal bones or displaced septum can be easily pushed into position. In many cases the Asch or D. Braden Kyle splint can be used to advantage in holding the septum in place. In the absence of nasal splints, iodoform or sterilized gauze may be used to hold the fragments in position. If the mucous membrane is lacerated, the gauze should be soaked with sterilized

albolene before being placed in the nose. The nasal fossa should be dressed every twenty-four hours to prevent infection. Various deformities or fracture of the external nose should, at the same time, be corrected by manipulation. The tin or lead splint can be shaped to the nose and fixed in position by a strip of adhesive plaster.

Cobb's splint is especially recommended when pressure is only necessary on one side to keep the nose in position. During the first twenty-hour hours, when it is necessary to pack the nose, the nasal cavity should be sprayed every two hours with iced Dobell's solution. Compresses dipped in cold bichlorid solution should be placed over the bridge of the nose for the first twenty-four hours following fracture.

Paraffin Prosthesis.—Since the introduction of the paraffin injection for the correction of deformity by Guersny in 1900, injection of paraffin for the correction of saddle nose has come into universal use with evidence of lasting satisfactory results.

Some of the untoward sequelæ that may follow paraffin injection are toxic absorption, continued pain from undue pressure, formation of abscess, air embolism, paraffin embolism and hyperesthesia of the skin.

The paraffin prepared by Chas. N. Leigh, chemist, New York, with a melting point 110° F., as suggested by Dr. Harmon Smith, has proved extremely satisfactory to the author. The syringe used is that designed by Dr Harmon Smith, which can be bought at any instrument house.

The paraffin may be melted in the small test-tube and can be drawn into the syringe in a liquid form. After cooling, "so that the paraffin emerges from the needle in a thread-like string," it is ready for injection.

The technique of the operation consists in sterilization of the instrument and thorough cleansing of the nose over the site of the intended operation. The nose and face should first be cleansed with clean soap and water and alcohol. The surgeon's hands should be cleansed as for any surgical operation.

The question of preliminary local anesthesia is governed by the condition of the patient. The operation has been performed at the

Bobb's Free Dispensary of the Indiana Medical College without local anesthesia, the patients making little or no complaint. However, in nervous individuals, Schleich's solution or a two per cent. solution of cocain may be injected into the subcutaneous tissue.

The point of the needle is inserted into the subcutaneous tissue and passed to the point from which the moulding of the parts is to begin. By gently twisting the screw of the syringe and at the same time slowly withdrawing the needle, the paraffin is forced gently into the tissue and is moulded with the thumb and forefinger sufficiently to overcome the deformity.

Two or more injections may be necessary to bring about satisfactory restoration of the parts.

The after-treatment consists in covering the wound produced by the needle with collodion. Cold pressure should be applied to the nose for from twelve to fifteen hours.

Internasal Adhesions.—Fibrous adhesions may be congenital or acquired. If acquired, they are due to ulceration of the mucosa from infection, syphilis, nasal diphtheria, purulent rhinitis, application of the electro-cautery or internasal operation.

Bridge-like bands may be situated in any portion of the nose, but more often join the lower turbinate with the septum. They are fibrous in character and may become cartilaginous or infiltrated with calcareous matter. The size of the band is variable and may be thread-like or very broad and thick.

Symptomatology and Diagnosis.—There is obstruction to breathing and frequently accumulation of mucus, which the patient is unable to dislodge by blowing the nose. The patient may complain of headache, insomnia and general disturbances. Post-nasal catarrh and Eustachian-tubal catarrh are frequent complications of the disease.

Anterior bands are easily detected upon inspection. Posterior adhesions frequently demand shrinkage of the nasal mucosa and exploration with a cotton-tipped probe for their detection.

Treatment.—The treatment is governed by the size of the band. Small bands may sometimes be destroyed by the application of chromic acid or the electro-cautery. Large fibrous or cartilaginous

bands should be removed with scissors. The after-treatment consists in preventing new formations by strips of gauze or Pynchon hard-rubber splint. The splint or gauze should be changed daily, followed by irrigation of the nasal cavity with a warm alkaline solution. The treatment should be continued daily until the cut surfaces are entirely covered with mucous membrane and all tendency to new adhesions has passed away.

Congenital Occlusion of the Nares.—Partial or complete congenital closure of the nares is infrequently observed. The situation of the obstruction is more often the post-nares and is due to an outgrowth from the hard palate. The anterior nares may also be partially or completely closed. The occlusion is probably due to faulty development in the mucous membrane during embryonic life.

Symptomatology.—The patient complains of inability to breathe properly on one or both sides, more or less loss of smell and subjective aural symptoms. The subjective symptoms are usually those of ordinary nasal catarrh.

Diagnosis.—If the web-like deformity is situated anteriorly, diagnosis is established by inspection. In post-nasal congenital atresia, the deformity is detected by passing a probe through the nares, when a smooth, hard, membranous obstruction is encountered and can be outlined with a cotton-tipped probe. In the case observed by the author, there was no secretion in the post-nasal space.

Treatment.—The wisdom of operating depends upon the amount of discomfort produced by the obstruction. If confined to one side, the obstruction had better be left alone. Should both sides be affected, one or both sides may be opened by boring through the osseous web with an electric trephine and formation of a window with saw and scissors. The after-treatment consists in rest in bed and frequently spraying the nose with a solution of Dobell's and adrenalin chlorid 1/3,000, for the first twenty-four hours. The further treatment consists in daily irrigation of the post-nasal space until the tendency to accumulation of mucus has passed away.

CHAPTER XXI.

DISEASES OF THE NOSE (CONTINUED).—DISEASES OF THE SEPTUM.

Deflection of the Septum.—*Etiology.*—The cause of deviation of the septum is still a matter of conjecture. In the eight hundred and fourteen crania of aborigines collected from the American continent, Freudenthal found deviation of the septum in two hundred and sixty-four cases. The theory advanced by Freudenthal and Chairi is based on the rule that in most individuals a slight concavity of the septum takes place on the side of the body more strongly developed. Deflection may be due to heredity, a fall upon the face in infancy, abnormal growth on the turbinate pressing on the septum of the opposite side, injury of the child during delivery, inherited syphilis and mouth breathing from adenoids, producing a high and arched palate with a narrowing of the upper jaw and consequent defection or bowing of the septum, from want of space for complete development. According to Zuckerkandl, deviation seldom occurs before the age of seven. The septum may be bowed, ridged or a sigmoid deflection with exostosis and fibrous changes and may be located interiorly or under the floor of the septum. The stenosis from deflection may be so great as to bring about a total atresia of one side.

Symptomatology and Diagnosis.—The symptoms are difficult breathing, frequent attacks of acute coryza and catarrhal deafness. Pressure from the deflected septum may bring about severe nervous manifestations and may excite epileptic attacks, hay fever, headache, and general nervous debility. Under good illumination, the diagnosis is comparatively easy. Exostosis should not be confounded with deflection of the septum. It frequently occurs that enlarged middle turbinates may press against the septum, producing a bowed condition. There sometimes exists a deformity of the external nose as a result of the septal deflection.

Treatment.—In infants and the young, the naso-pharynx and pharynx should be restored to as near the normal as possible. Narrowing of the upper jaw should be corrected by dental prosthesis, before resorting to surgical measures. The submucous resections, so-called "window resection," advocated first by Ingals and later by Krieg, have come into great favor both in this country and Europe. The operation consists in removing in part or entirety the deviated cartilage and allowing the mucous membrane to remain intact. This operation with modifications is recommended by Ingals, Krieg, Boenninghaus, Moore, White, Peterson-Hartman, Freer, Hajek, Menzel and others, and consists in making an incision into the mucosa and through the perichondrium down to the cartilage and removal of the deviation in a variety of ways with specially constructed instruments. The operation is performed under cocain anesthesia and with the patient sitting in an upright position. The method of Ballenger (*The Laryngoscope*, June, 1905) is a modification of the Ingals and Krieg operation and is a method which has been successfully used by the author in a number of cases.

"The technique of the operation," according to Ballenger, "is after the Menzel-Hajek method with the exception of the removal of the cartilage. In the Menzel-Hajek operation, the cartilage is

FIG. 119.—BALLENGER SEPTUM KNIFE.

removed piece by piece with punch forceps; whereas, by my method, it is removed in one piece with one cut of the swivel knife. The time required for the removal of the cartilage after the muco-perichondrium has been elevated need consume but a few seconds; whereas, by the Menzel-Hajek method, it takes from a few to several minutes for its removal. Using a special knife (Fig. 119), I make a curved incision in the septal mucosa of about one inch in length, beginning near the floor of the nose and curving forward and upward, as high as I can, through the vestibule of the nose and about one-fourth inch posterior to the anterior margin of the cartilage. I have

not found it necessary or expedient to make the incision on the convex side of the septum, as is commonly recommended; but I find it advisable to make it on the left side of the septum regardless of whether this is the convex or the concave surface. I do this because it is convenient to use the knife with the right hand while the forefinger of the left is inserted into the right nostril. Having made the curvilinear incision through the muco-perichondrium on the left side of the septum, I next resort to the semi-sharp elevator of Hajek (Fig. 120) to elevate the anterior portion of the muco-perichondrium from the septum after which Hajek's blunt elevator (Fig. 120) should be used. The semi-sharp elevator should only be used to start the elevation, as to

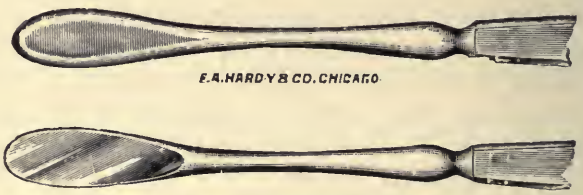

FIG. 120.—HAJEK'S MUCOPERICHONDRIAL ELEVATOR.

continue its use might result in a perforation of the mucous membrane, whereas, the dull elevator can be used with great rapidity without danger of perforation.

"The next step in the operation consists in carrying the anterior curvilinear incision of the mucosa through the septal cartilage to the perichondrium of the opposite side. This is done with a small bistoury (see Fig. 119), the forefinger of the left hand being inserted into the right nostril to detect when the cartilage is completely incised. After one has had considerable experience in the incision of the cartilage with a knife, he may not find it necessary to introduce the finger into the opposite nostril as he can readily appreciate when he is through it by the sense of touch or by the resistance felt with the hand holding the knife. The semi-sharp elevator of Hajek may be used to perforate the cartilaginous septum along the line of the curvilinear incision by rubbing it to and fro in the muco-perichondrial incision, the index finger of the left hand being inserted in the right

nostril to exert counter pressure and to detect by the tactile sense when it is completely broken through.

"The incision through the cartilage having been made by either of the above methods, the semi-sharp elevator should be inserted through it with the flat side turned so as to lie against the right side of cartilaginous septum, and, while in this position it should be moved up and down and insinuated between the cartilage and the muco-perichondrium of the right side. To facilitate this procedure, the tip of the nose should be turned toward the patient's right side thus exposing the curvilinear incision through the mucosa and cartilage, and making it possible to introduce the semi-sharp elevator on a plane parallel with the septum. After this side is started, the dull elevator is used to complete the separation. Care should be taken to lift the muco-perichondrium from the entire deflected area, as to fail to do so makes it impossible to remove a sufficient amount of the cartilage.

"The muco-perichondrium on both sides of the septum now being elevated, the prongs of the swivel fork are introduced through the curvilinear incision, one prong being on the right side of the septum, and the other on the left. The instrument should now be directed backwards parallel with the floor of the nose until the posterior limit of the cartilage is reached, when it should be directed upwards and forwards following the outline of the anterior end of the perpendicular plate of the ethmoid to the bridge of the nose, when it should be pulled downward parallel with cavity, the triangular blade resting upon the concavity of the ridge of the nose to the upper extremity of the curvilinear incision. In this way almost the entire cartilaginous septum, except the anterior tip which is left to support the tip of the nose, is removed. The excised cartilage should now be seized with a pair of dressing forceps and removed through the

FIG. 121. BALLENGER'S SWIVEL KNIFE.

curvilinear incision. The cartilage thus removed is usually roughly triangular in shape, the acute point of which represents the posterior end of the cartilage.

"It is obvious that this method of removing the cartilage is a rational one, as if does it with ease, rapidity and without traumatism or laceration of the mucous membrane."

For the removal of a portion of the bony septum, Freer's modification of Gruenwald's punch forceps may be used. With the instrument, according to Freer, bone one-eighth of an inch thick can be bitten in two. With this instrument, the bony septum may be removed, piece by piece. After removal of the cartilage, the nasal cavity and wound are cleared of all debris. The mucous membrane is brought into as near normal apposition as possible and covered with gauze previously dipped in albolene. Over this a very light packing of bichlorid gauze is placed. On the opposite side of the nose, a light packing of gauze may be placed as a support to the membranous septum. The dressing on both sides may be dispensed with the following day. The nose should be cleansed twice daily with Dobell's solution until recovery is complete.

Perforation may recur in this operation as in the Ingals or Krieg operation. However, with familiarity and skill in making the incision of the cartilage, perforation of the mucous membrane on the opposite side may be prevented.

The technique of the Asch operation consists in complete anesthesia following irrigation of the nasal cavity. The head of the patient is placed inclining downward over the edge of the operating table. With a blunt or sharp separator, the adhesion of the septum and the turbinates is first broken up. The Asch septum scissors are now quickly passed into the nasal septum and the straight blade over the convexity. They are then forcibly closed, making a button-hole incision. They are now withdrawn and a second incision is made in a vertical direction over the first incision, which was parallel to the floor of the nose. With the finger in the nose, the convex portion is forcibly pushed into line, breaking the segments at the base. The compression forceps are now introduced further to strengthen the septum. Immediately, the previously sterilized rubber splints are

forced into the nose and held in position by strips of adhesive plaster, the nose is sprayed with sterilized iced Dobell's solution and bichlorid solution. The patient is instructed to remain in bed for four days.

The subsequent treatment is spraying with Dobell's iced solution every hour for twenty-four hours. Ice compresses should be kept on the nose for twenty-four hours after the operation. Cold spray and applications not alone guard against hemorrhage, but prevent inflammation. After twenty-four hours the tube on the side of the concavity is removed, the nasal cavity cleansed and sterilized and the tube reinserted. The tube is discarded after forty-eight hours. The tube on the convex side is removed after forty-eight hours, sterilized and reinserted. This tube is sterilized daily and worn for one month. As a rule, the results are satisfactory. A few cases of septic infection following this operation have been reported.

Abscess.—Abscess of the septum is a circumscribed collection of pus.

Etiology.—The cause of a localization of pus in the septum is usually some form of trauma and frequently follows fracture, especially fracture of the nasal bones. A blow upon the nose may produce an effusion beneath the perichondrium of one or both sides or a rupture of the cartilage and effusion, which may become infected and lead to the formation of pus.

Symptomatology.—There is usually a history of traumatism, with pain and swelling of the septum and nasal stenosis. The patient complains of headache and rise of temperature.

Diagnosis.—The septum bulges into the anterior nasal cavity, producing partial or complete stenosis. The mucous membrane is paler than normal and dry and glistening. Upon palpation, the septum is tender and painful. Fluctuation, indicative of pus, may sometimes be detected. Pus can be discovered by making a free incision into the septum at the point of infection.

Treatment.—A free incision is indicated wherever pus is suspected, and the opening prevented from closing with tampons of bichlorid gauze. The septal abscess should be irrigated once daily with a weakened normal salt solution, followed by tamponing. The length

of treatment varies and may be continued for a number of weeks. More or less deformity of the septum usually follows.

Ulceration.—Ulceration of the septum may be confined to the mucosa or involve the mucous membrane and cartilage and is perforating or non-perforating. There is a localized solution of continuity of tissue without a disposition to heal.

Etiology and Pathology.—The causes are both predisposing and exciting. Predisposing causes of ulceration are syphilis, tuberculosis, herpes, varicosities, atheroma, diphtheria, irrigations continuously applied to the mucous membrane, irritating gases and the habit of picking the nose.

The exciting causes are infection from some pathogenic organism, among which are the staphylococcus pyogenes aureus, streptococcus pyogenes, gonococcus (gonococcus infection would probably be by metastasis, as only one or two cases of gonococcus infection of the nose have been reported), actinomycosis, tubercle bacilli, bacillus scleroma, bacillus coli communis and diplococcus pneumoniæ.

Symptomatology.—This condition is usually one of slow development. There may be little or no pain accompanying the formation of an ulcer. The patient may complain of frequent attacks of epistaxis and accumulations of crusts in the nose, which the patient attempts to dislodge by picking the nose.

Diagnosis.—A perforating ulcer is easily detected. If progressive, the rim of the ulcer will be covered with blood crusts which leave a bleeding surface upon being removed. A superficial ulcer is grayish in appearance, circumscribed and covered with mucus or mucopus. If there is much destruction of tissue, the cartilage may be exposed.

Treatment.—If the ulceration is due to syphilis, mercury by inunction and iodid of potassium in large doses are indicated. If the disease is due to tuberculosis or infection from one of the many causes enumerated, the treatment is more especially local and consists in frequent irrigations with a warm alkaline wash, stimulating repair with daily applications of a solution of nitrate of silver, twenty to thirty grains to the ounce with a cotton-tipped probe. The patient may be given a stimulating ointment, compound of the yellow oxid

of mercury, eight grains to the ounce of lanolin, to be applied to the surface of the ulcer twice daily.

Constitutional treatment is directed to building up the system with tonics and alteratives.

Perforation of the Septum.—Perforation of the septum may be of the cartilaginous or bony portion. Perforation of the bony septum probably exists more often than is supposed, but is overlooked on account of the location.

The cause may be stab, untoward accident from removal of a spur or deflection, gunshot, abscess, syphilis or tuberculosis. Syphilis is probably the most important factor in the causation of perforation of the septum. One should not beguile himself into believing that all perforations of the septum are pathognomonic signs of syphilis. The septum is unnecessary for the preservation of the symmetry of the nose. As long as the bony structures are unaffected there is no danger of collapse of the nose (see Fig. 113).

Treatment.—The treatment varies, and if due to syphilis, general antisyphilitic treatment is necessary to prevent the spread of the affection. Perforations from trauma or local infection are usually small and have no tendency to destroy all the cartilage. The treatment consists in frequently cleansing the nose, applications of nitrate of silver, sixty grains to the ounce, and the administration of tonics and alteratives.

Spurs on the Septum.—*Etiology.*—Spurs on the septum may be located on the cartilaginous or bony portion and may extend the entire length of the septum. The causes are congenital influences, fall upon the nose or inflammation of the mucous membrane extending down to the perichondrium or periosteum.

Pathology.—Spurs may be fibrinous, cartilaginous or osseous and covered with mucous membrane.

Fibrinous or cartilaginous spurs may undergo partial or complete osseous degeneration. The disease is frequently due to a mild localized perichondritis or periostitis, with subsequent hypertrophy and hyperplasia.

Symptomatology.—The patient frequently complains of nasal stenosis, ringing in the ears and progressive deafness. There is a

disposition to repeated attacks of cold in the head. Spurs are presumed to excite reflex disturbances, *i. e.*, hay fever, headache, cough, asthma and prodromes of epilepsy. The position of the spurs is quickly noted upon inspection. The spur may or may not impinge upon the turbinate. There is always a question in regard to the possibility of irritation from a small spur on the septum. Whether or not a small spur with free breathing space and no catarrhal or inflammatory condition of the mucosa demands removal must be judged solely by the physician. In a case with catarrhal inflammation of the nose with ear complication, the nasal cavity should be restored as far as possible to a symmetrical and normal condition.

Diagnosis.—From the foregoing enumeration of symptoms, the diagnosis is easy. The condition should not be confounded with papilloma, tubercular nodule, abscess of the septum or osteoma.

The question of the influence of a spur as a cause of reflex disturbances can only be settled by its complete removal.

Treatment.—Spurs on the septum should never be cauterized for fear of subsequent ulceration and thickening. Their removal should be by knife, saw or bur. Frequently a small cartilaginous spur may be removed by submucous dissection. An incision, as for window resection, may be made, the flaps turned inward and the spur shaved off with a knife and scissors. The flap is returned to its normal position and gauze dressing applied. Where the growth has undergone an osseous degeneration, the saw or bur is necessary. There is more or less destruction of the mucous membrane with the use of the saw. It is frequently advisable to shave the spur from the septum without regard to the preservation of the mucous membrane. With a sharp knife, the spur may be cut through from above downward. If bone is encountered, the incision may be completed with a saw. As soon as the soft tissue is encountered, the knife or scissors may be used to completely sever the spur. The spur is lifted from the nose with a goose-neck forceps. The after-dressing consists in frequently spraying the nose with Dobell's solution and adrenalin chlorid, 1/3,000. If hemorrhage is anticipated or should occur, the wound should be covered with a thin strip of oiled gauze over which is packed strips of gauze, which should be removed the following day. The strip of

gauze covering the wound may remain from forty-eight to fifty-two hours, the gauze having been previously soaked in adrenalin to avoid hemorrhage following its removal, caused by the fibers adhering to the wound. The mucous membrane quickly re-forms over the wound. Should granulations occur at the site of the wound, they may be destroyed with a strong solution of nitrate of silver or scissors. If there is a tendency of the lower turbinates to adhere to the septum from the operation, a Pynchon hard-rubber splint should be worn in the nose for a few days or until the mucous membrane of the septum is regenerated.

Dislocation of the Columnar Cartilage.—The columnus is that small, narrow portion of the cartilage supporting the tip of the nose and separating the two nostrils. Frequently from a blow or fall upon the nose, kick of a horse, ulceration or injury during birth, the cartilage may be dislocated. Collapse of the nose may accompany dislocation of the cartilage.

Treatment.—The operative procedure varies according to the deformity. If the detached portion stands out into the vestibule knuckle-shaped, an incision along the junction of the skin and mucous membrane may enable a submucous resection of the cartilage and its complete or partial removal. Should the base of the cartilage be directed to one side, the plastic operation for its removal should be performed.

Fracture of the Septum.—(See Fracture of the Nose.)

CHAPTER XXII.

DISEASES OF THE ACCESSORY SINUSES OF THE NOSE.

Acute Catarrhal Inflammation of the Frontal Cells.—On account of the position of the naso-frontal duct and the tendency to uninterrupted drainage, the frontal cells are less liable to inflammation than the sphenoidal or ethmoidal cells, but when once diseased are more difficult to cure. As a result of the extension of the same kind of epithelium as found in the nasal cavity, the frontal cells are involved in the majority of cases of acute coryza and exanthematous disease.

Etiology.—The disease may occur independent of any previous catarrhal infection of the nasal mucosa or, as a result of extension, by continuity of tissue. Acute coryza is probably the most pronounced factor in the causation of the disease. In addition to acute coryza, may be mentioned exanthematous diseases, typhoid fever and influenza. The predisposing causes are catarrhal diathesis, syphilis, tuberculosis, inflammation of the anterior ethmoidal cells, malformation of the middle turbinate and deflected septum. Edema of the mucous membrane of the ostium may produce complete closure of the frontal cells with retention of air in the cells. The air may be absorbed and predisposes to passive hyperemia with hemorrhagic extravasations into the mucosa.

Pathology.—There is present a hyperemia and edema of the epithelial structures with increase of glandular secretion. The character of the secretion varies with the cause of the disease, and is at first clear mucus and serum, becoming slightly turbid after a time from exfoliation of epithelium and broken-down leucocytes. With the introduction of infection into the sinus, the disease rapidly passes into a condition of acute purulent sinusitis.

Symptomatology and Diagnosis.—Pain, unilateral or bilateral, over the frontal region, which is aggravated by assuming a stooping

posture, coughing, blowing the nose, and nasal tones in speaking are characteristic symptoms. The disease may run its entire course without pain. More or less congestion of the nasal and conjunctival mucosa may be noted. The discharge from the cells is at first a thin, stringy mucus, later becoming muco-purulent. The discharge from the cells is sometimes very profuse and continues for a number of days. Upon inspection of the nasal cavity, the thick sero-mucus will be seen draining anteriorly and in the trough formed by the septum and bony structure dense mucus can be detected emptying into the middle meatus.

Treatment.—Where there is much congestion about the naso-frontal duct, symptoms of fullness in the attic of the nose can be relieved for a very long time by causing the patient to lie prone upon a table or couch with head extending over the edge, in which position four or five drops of equal parts of adrenalin chlorid, witch hazel and camphor water distilled, may be injected into the anterior attic of the nose with an ordinary medicine dropper. There will be slight pain following the injection, which passes away in a very few seconds. After four or five minutes, a warm oil solution composed of two per cent. camphor, menthol and cocain in albolene, may be distilled into the region of the naso-frontal duct with the patient in the same position as before. If the physician desires, the patient's home treatment may consist of the same method of treatment or a frequent spraying of the nose with a warm, mild alkaline solution, followed by a two per cent. campho-menthol in oil or adrenalin in oil. It is better to keep the mucous membrane retracted by cocain or adrenalin sufficiently long to allow the contractor fibers of the blood vessels to regain their normal tone. Adrenalin in neutral oil may be prescribed as a substitute for cocain.

Dry heat over the affected part should be ordered for as near constant use as possible. The pain may often be controlled by dry heat. Any lithemic condition should be overcome with the free administration of water.

A warm foot-bath at bed time with ten grains of Dover's powders internally for the adult, followed by a saline upon arising, should be administered when the inflammation is acute. If the disease

persists for any length of time, the administration of those drugs which tend to stimulate elimination is indicated, such as benzoate of sodium in ten grain doses three times daily. Topical applications of warm irrigations and sprays of hydrocarbons should be frequently used. Tampons of cotton dipped in fifty per cent. solution argyrol are efficacious if placed far up into the nasal cavity. Where there is no chance of exposure, Turkish baths are of great value. Surgical measures may be subsequently demanded for the removal of hypertrophy of the middle turbinated bones, deviation of the septum and polypi.

Chronic Catarrhal Inflammation of the Frontal Cells.—*Etiology.*—Chronic catarrhal inflammation of the frontal cells is due to successive attacks of acute inflammation of the mucous membrane lining the frontal cells, produced by successive attacks of cold in the head, exanthematous disease, tubercular diathesis, chronic catarrhal inflammation of the ethmoidal cells, hypertrophy of the middle turbinated bodies, tumors, foreign bodies and any condition which may produce a chronic inflammation of the mucous membrane of the naso-frontal duct.

Pathology.—The entire mucous membrane lining the canal becomes involved, with sometimes a slight involvement of bone. The mucous membrane becomes thickened and hypertrophied. There is a chronic catarrhal exudation constantly thrown off, which may be filled with broken-down epithelial cells and leucocytes. Exacerbations of the disease frequently occur at the end and beginning of winter, when the days are damp and chilling.

Treatment.—The treatment is primarily directed to the removal of any internasal obstructions around the naso-frontal duct and the correction of any local or general catarrhal condition and constitutional dyscrasia. If the tip of the middle turbinated bone impinges upon the lateral wall, preventing free drainage into the meatus, it should be removed with the Holme's scissors and snare. Where the condition is due simply to narrowing of the canal from hypertrophy of the mucous membrane, dilation with a Freeman's frontal duct bougie is indicated (Fig. 79).

In addition to the tampons of cotton, a fifty per cent. solution of

argyrol may be placed in the infundibulum once daily and allowed to remain for ten minutes. Hot antiseptic or alkaline solutions should be prescribed as a spray for home use. If there is very much secretion from the frontal cells, they may be irrigated through a Hartman cannula with Dobell's solution, provided the pain is not too great.

The rules of personal hygiene should be rigidly enforced. The patient should take plenty of out-door exercise and avoid exposure to irritating gases, tobacco smoke and the over-use of alcoholic liquors. A general tonic is usually indicated for the stimulation of cellular metabolism.

Acute Purulent Inflammation of the Frontal Cells.—Acute purulent inflammation of the frontal cells occurs from an obstruction of the naso-frontal duct, due to acute inflammatory swelling of the mucosa. The mucous exudation within the sinuses becomes infected with pathogenic organisms and rapidly changes to pus.

Etiology.—The causes of acute purulent inflammation of the frontal cells are both predisposing and exciting. Among the predisposing causes are lowering of the tissue resistance of the mucous membrane lining one or both sinuses, more often unilateral, from acute coryza, la grippe, operations in the nose, removal of posterior spurs, turbinotomy, exanthematous diseases, lowered vitality from tubercular diathesis, syphilis, exposure to damp and chilling weather and acute or chronic inflammation of the ethmoidal cells. Hypertrophy of the middle turbinated body, on account of the possibility of permanently or temporarily obstructing free drainage from the infundibulum, from acute swelling, is a very important factor in the etiology of the disease.

The exciting causes are more often the presence of some pathogenic organism, especially the grip bacillus or the staphylococcus pyogenes aureus or albus. The infection may be mono-bacterial or poly-bacterial.

Pathology.—The disease may extend from a like condition of the mucous membrane or occur as a primary inflammation of the frontal cells. From the anatomical structure, the inflammation probably begins as a primary inflammation of the naso-frontal duct and is

due to some injury of the epithelium followed by infection. There is a swelling of all or a portion of the mucous membrane lining the cavity, followed by exudation of serum or fibrin with an exfoliation of epithelial cells and a leakage of leucocytes. A rapid swelling of the mucous membrane lining the naso-frontal duct may prevent free egress of air into the cells and in consequence, a serous congestion may follow with leakage through the blood vessel's wall and hemorrhagic extravasations. With the presence of pyogenic organisms, the mucous or fibrinous exudation is changed by a process of peptonization into muco-pus and as a result of the chemical change toxins may be eliminated, which affect the caloric centers, causing a variation in the temperature of the body.

Symptomatology.—The patient may or may not complain of stoppage of the nose. Pain in the frontal region, sometimes radiating to the temple, ear and back of the eye, increasing in character, is the one symptom complained of most. The pain necessarily increases as the secretion fills the cells. With the periodical discharge of the secretion from the cells, the pain lessens and may even disappear for a short time. The pain may come on early in the morning with the rising of the sun and in consequence, has received the cognomen of sun pain. However, the pain may make its onset later in the day and is intensified upon movement, such as walking or stooping. The conjunctiva of the same side may appear injected and sometimes edematous. The patient complains of tenderness upon percussion and pressure. Frequently there are marked systemic disturbances, loss of appetite, elevation of temperature, a general cachexia and rapid loss of flesh. Upon examination of the nasal cavity when partial drainage is in progress in the early stage a thick, tenacious and glairy mucus is detected, which, with the increase of leucocytes, changes into pus or muco-pus, and may be observed oozing from the juncture of the anterior tip of the middle turbinate and outer wall of the nasal cavity. The turbinate may be so swollen that it is nearly impossible to pass a cotton-tipped probe into the middle meatus. By watching the point from which any muco-pus has been removed, a reaccumulation is observed after a few seconds. A slight necrosis of the epithelium at the site of the pus may be observed

in some cases. If the tissue reacts to the application of a five per cent. solution of cocain and adrenalin 1/5,000, the positive source of the pus is easily disclosed.

Diagnosis.—With the foregoing enumeration of symptoms, the diagnosis is usually very easy. The tuning fork, when applied to the frontal bone on the affected side, will not be heard as distinctly as on the unaffected side. When pus is present, transillumination will show a darkened area in the affected region. The diagnostic lamp should be placed in the angle formed by the nose and eyebrow.

Course and Prognosis.—The course of the affection is exceedingly variable, the disease usually ending in from one to two weeks. There is always a tendency to recurrence after a few weeks or during the damp, cold days of the winter months, with a lapse into a chronic, purulent, frontal inflammation. Under careful treatment, however, the disease often ends in complete recovery. At the time free drainage has established itself, the pain ends suddenly and convalescence takes place very rapidly.

Treatment.—External operative treatment for the relief of acute, purulent inflammation of the frontal cells is seldom, if ever, demanded.

Local treatment consists in the application of a five per cent. solution of cocain and 1/5,000 adrenalin chlorid to the region of the infundibulum, followed by a warm alkaline spray. The cocain and adrenalin should be applied every two hours to the region of the inflammation, with a cotton-tipped probe or spray. Warm two per cent. camphor and menthol in albolene may be dropped into the nose with the head thrown far back as in the treatment of acute or chronic catarrhal inflammation (see page 400). Patients frequently express themselves as being greatly relieved by the application of this soothing solution. Dry heat in the form of a Japanese hot-box or a hot-water bottle should be constantly applied over the affected region.

Free purgation should be encouraged by the administration of calomel in one-tenth grain doses until the free evacuation of the bowels is accomplished.

If the pain is very severe, hypodermic injection of morphin in one-eighth to one-fourth grain doses may be given. Massage or gentle friction over the site is often very beneficial.

It is advisable to confine the patients to bed, but in spite of this advice, they insist upon seeing the physician at his office.

After the active inflammatory stage has passed away, the sinuses may be flushed with a warm boracic or normal salt solution once daily. The nose should be sprayed frequently with a warm alkaline solution. The patient must guard against exposure to cold, damp weather for a few weeks following the inflammation. A general tonic treatment is usually indicated for a number of weeks after convalescence has been established.

Chronic Purulent Inflammation of the Frontal Cells or Latent Empyema.—As the name implies, chronic purulent inflammation of the frontal cells is a chronic purulent inflammation of the

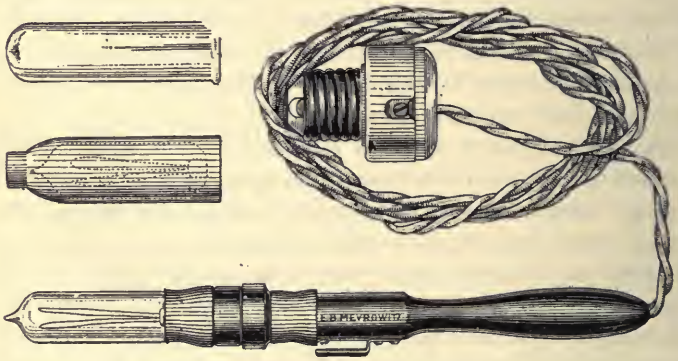

FIG. 122.—JACKSON-FREER TRANSILLUMINATION FOR FRONTAL SINUS AND ANTRUM OF HIGHMORE.

mucosa lining the frontal sinuses. One or both sides may be involved. The two sinuses may be connected by a small perforation of the septum, or one sinus only may exist, as shown by Turner.

Etiology.—The causes are more often successive attacks of acute purulent inflammation of the frontal cells, in which there is gradual formation of hypertrophies and myxomatous growths about the ostium frontalis, which prevent free drainage from the sinuses and encourage multiplication of infection within the sinuses. A chronic purulent inflammation of the ethmoidal cells may produce a like

condition of the frontal cells. An acute empyema of the frontal cells may rupture into the ethmoid cells or orbital cavity, producing a secondary inflammation.

Symptomatology.—The symptoms are somewhat variable and are frequently so obscure as to render the diagnosis often purely conjectural. The most important symptom is the discharge of pus from the region of the naso-frontal duct, continuing over many weeks and months. The character of the pus likewise varies and may be muco-purulent or thick and yellowish.

Turner speaks of Killian's observation upon the green color of the pus from the frontal sinuses and says that too much diagnostic importance must not be attached to any of the physical characteristics of nasal discharge. Small muco-purulent crusts may form in the attic of the nose. Turner mentions as a diagnostic aid in sinus disease a condition which has frequently been observed by the author, that the sufferers are conscious of a fetid odor which an observer is unable to detect.

The pain of chronic frontal empyema is somewhat variable in intensity and sometimes produces night terrors and restlessness. Pain at the root of the nose may be aggravated by stooping and exposure to damp weather. There may be more or less pain upon pressure, especially in the supraorbital region.

Diagnosis.—In unilateral purulent empyema, the discharge will be from one side and may be detected making its appearance at the anterior attic of the middle meatus. According to Gruenwald, Turner and others, pus originating in the frontal sinuses may, providing the naso-frontal duct is susceptible to catheterization, be demonstrated by passing a probe or cannula into the frontal duct and observing the flow of pus along the side of the cannula. Sometimes during the irrigation of the sinuses, pus may be detected flowing from the region of the ostium.

Information gained by transillumination is sometimes very unsatisfactory; however, a shadow should be looked for.

Treatment.—The treatment in simple, uncomplicated, chronic, purulent inflammation of the frontal cells without involvement of the ethmoidal cells or deformity of the middle turbinated bone,

consists in irrigation of the frontal sinuses with a mild alkaline solution. Myxomatous growths and hypertrophies of the middle turbinate should be removed. It is sometimes only necessary to remove the anterior half in hypertrophies of the middle turbinate. Frequently the anterior portion of the lower turbinate is so hypertrophied that inspection of the middle meatus is nearly impossible. Such condition existing, the anterior portion or all of the lower turbinate should be removed. In suspected involvement of the ethmoidal cells, the middle turbinate should be removed. It is better to explore the ethmoidal cells for any suppurative foci. After free drainage is established as far as possible and the discharge continues with the distressing symptoms as enumerated above, the radical operation is indicated.

In the consideration of external operative measures, it is hardly necessary to reiterate a proven fact, that nothing but free exposure of the sinus should be undertaken, if the operation is at all indicated. There are many methods of external operative procedures, notable among which are those suggested by Bryan, Hajek, Killian, Ogston-Luc, Kuhnt and the different modifications, known as the Ogston-Luc, Hajek-Luc and the Kuhnt-Luc.

The technique of the different operations is described in numerous text-books and current literature. All operators practically advocate the enlargement of the naso-frontal duct and obliteration of the anterior ethmoidal cells, securing thus practical permanent drainage. The disposition of the external wall varies according to the operation. Some operators advocate complete closure of the external wound, others partial closure, allowing a strip of gauze or drainage tube to pass from the external surface into the nasal cavity. The deformity varies and necessarily depends upon the amount of frontal plates removed, and whether or not primary union of the cutaneous edges of the wound takes place. In the hope of preventing deformity, Czerny, Kuster, Lathrop and others have recommended an osteo-plastic operation, that is, a flap of bone is removed and replaced after curettement of the cells and establishment of free nasal communication.

A simple operative procedure and one attended by little or no

deformity, described and recommended by many surgeons, is the following:

The eyebrow of the affected side is shaved the night before the operation and the forehead and face washed with soft soap and water, followed by washing with pure alcohol. The parts are dried and covered with gauze and bandages. Before proceeding to the operation, the post-nasal space on the affected side is sometimes plugged with gauze. With chloroform or ether anesthesia, the parts being again disinfected, a curved incision is made from approximately the supra-orbital notch, along the lower edge of the eyebrow, to, or slightly below, the root of the nose, down to the bone. The periosteum is separated and pushed back with a periosteum elevator. The edges of the wound are separated with retractors. With a small trephine, or preferably, a gouge and mallet, an opening sufficiently large to expose the cells and permit of exploration is made on the line of incision and one-third the distance from a median line of the forehead to the supra-orbital notch. The hemorrhage is quite profuse and is controlled by compression or ligation of the supra-orbital artery. The bone at this point is thickest and requires considerable excavation to reach the muco-periosteal lining of the cells, which is of a dark bluish cast in counterdistinction to the white appearance of the dura mater. Where the skin incision is insufficient to expose the sinus for examination, a second and vertical incision from the base of the nose as in the Hajek-Luc operation, may be made and the triangular flap turned upward. The mucous membrane of the sinus is incised and the cavity explored with a blunt-pointed, malleable probe. Pus and debris should be washed away with a warm normal salt solution. Polypi, hypertrophies and muco-periosteal lining of the cavity should now be curetted away. The naso-frontal duct should next be located and enlarged with a curette and the anterior ethmoid cells broken through so that a free opening exists, as described by Turner, large enough to permit the passage of the little finger. Unless the opening is made as large as possible, there is no assurance against its early closure. The sinus is curetted in all its ramifications of all diseased mucous membrane and swabbed with a one-twentieth carbolic acid solution or a fifteen

per cent. solution of nitrate of silver. A drainage tube is now inserted within the sinus and anchored with a safety pin, the nasal end extending well into the nasal cavity. The wound is carefully closed up to the drainage tube. The external wound is covered with iodoform gauze and bandage. The patient is instructed to remain in bed quietly for four or five days. The wound is inspected in twenty-four hours and the drainage tube syringed thoroughly with a warm Dobell's solution. The tube should be worn for a number of weeks. A new tube may occasionally be inserted by attaching it to the old one and drawing it into the wound. After the tube is removed, the wound is allowed to heal.

A modification of the above operation in regard to the final closure of the wound is that of Luc, in which the sinus is packed with a strip of gauze, the end protruding from the nostril and the external wound entirely closed. The gauze packing is removed through the nose after two or three days.

In severe and complicated cases with entire involvement of the ethmoidal cells and inability to thoroughly curette the ramifications of the sinuses, the operation of Killian or the Kuhnt-Luc operation, *i.e.*, osteoplastic flap in place of chiseling away the outer table, is necessary.

The operation designed by Killian and known to the world as the Killian operation consists, in first sterilizing the patient's face with green soap, bichlorid of mercury and alcohol, and afterward wrapping the patient's head with a sterile towel. Cigar-shaped tampons of cotton wrapped in gauze are inserted with the aid of a long Killian speculum, deep into the nasal fossæ of the diseased side, completely plugging the fossa. Under chloroform narcosis and rigid antiseptic precautions, marking the course of the incision with short cuts through the skin, which will aid in the approximation of the edges of the wound in the final suturing, an incision is made from the temporal extension of the eyebrows to the middle of the base of the nose down to and through the periosteum. The vertical and lateral extension of the sinus is first, however, determined by a skiagraph. The sinus is perforated with a "V" shaped chisel, care being taken not to wound the mucous membrane. With a

blunt-curved probe separating the mucosa from the frontal plate, the vertical extension of the cell is discovered, and from this point a second incision is made in the median line down to and joining the primary incision at the base of the nose. The flap is now dissected upward. The frontal wall as outlined with a blunt-pointed probe is chiseled away down to the supraorbital margin. Following this, the entire inferior wall or floor is removed, with part of the lachrymal bone. The infundibulum is now opened into, and the ethmoidal and even the sphenoidal cells are exposed, followed by curettement of the entire diseased mucosa. The nasal mucous membrane is brought forward and stretched to the wound facing the nasal cavity. The flap of skin and tissue is now stretched into place.

The patient is instructed not to blow his nose, but to suck all the secretion back into the pharynx. The depression produced by the removal of the frontal wall, according to Killian, is filled up with granulation and but little scar results. During the removal of the upper wall of the orbit, there is great danger of injuring the eye.

Mucocele.—Mucocele is a retention cyst, due to a serous transudation from the mucous membrane lining the sinus, which is prevented from escaping by chronic catarrhal inflammation, tumors, hypertrophies, etc., of and about the naso-frontal duct.

Etiology.—The disease is often due to chronic catarrhal inflammation of the mucosa, extending primarily from the nasal cavity. Polypi, hypertrophies of the middle turbinate, caries and necrosis of the naso-frontal duct are important factors in the etiology of the disease.

Symptomatology.—When the naso-frontal duct is slightly open, the symptoms are those of a chronic catarrhal inflammation of the frontal cells. The patient complains of great distress at the base of the nose and along the frontal prominence. Where the naso-frontal duct is completely closed, the pain becomes very great from distension and pressure. The pressure may be so great as to cause the tumor to bulge into the nose. The cyst wall and contents may degenerate with the formation of straw-colored fluid or pus. The symptoms then become those of empyema.

Diagnosis.—Pain in the supra-orbital region and root of the nose, history of occasional discharge of mucus from the anterior nares, tenderness and swelling at the inner angle of the orbit are signs of the disease.

Treatment.—If the cystocele bulges into the nasal cavity, it should be opened by incision. Sometimes by the evacuation of the contents of the cyst the naso-frontal duct dilates and in due course of time returns to the normal without further operative procedure. If there is a retention cyst of the sinus, the treatment is the same as for empyema of the frontal cells. The cells should be opened by one of the more simple operations and the serous exudation evacuated and the cavity irrigated with a saline solution. The wound should be prevented from closure by tamponing with strips of iodoform gauze. The cavity is irrigated once daily until free and uninterrupted drainage is established through the naso-frontal duct.

Foreign Bodies in the Frontal Cells.—Foreign bodies in the frontal cells may gain entrance through the naso-frontal duct and may be maggots, screw-worms and other insects. Foreign bodies which gain entrance from the exterior are bullets from gunshot, point of knife blade from stab, and particles of iron due to explosion.

Symptomatology.—In the consideration of insects in the frontal cells, Burnett makes special mention of marked depression of the general health, followed by intense frontal headache, frequent epistaxis, muco-purulent discharge from the nose, severe swelling of the eyelid, the patient becoming delirious and frequently developing suicidal mania.

Diagnosis.—The diagnosis of insects in the frontal sinus is difficult and may only be differentiated when the larvæ are discovered escaping from the naso-frontal duct with the nasal muco-purulent secretion or upon trephining of the cells. The diagnosis of the presence of inanimate objects is usually by history of the case or inspection of the wound.

Treatment.—The treatment for foreign bodies in the frontal sinus is necessarily surgical and consists in trephining the sinuses and irrigation. The wound is irrigated with a mild antiseptic solution and tamponed with iodoform gauze. After all danger of

infection is passed, the tampon may be removed and the wound allowed to close by granulation, which is usually very rapid.

Fracture of the Outer Plate.—Fracture of the outer plate may result from a blow or fall upon the forehead. A fracture may be depressed, compound or comminuted. The outer plate may be so shattered that there is complete exposure of the frontal cells, sufficient to allow insertion of the finger.

Treatment.—In simple depressed fractures, the treatment is rest in bed and cold applications over the site of the injury for the first twenty-four hours. Sometimes severe vomiting and nervous disturbances follow from this injury but are purely transitory in character. In compound comminuted fractures, small spicula of bone should be removed; provided there is no undue pressure on the internal plate, depressed bone may be left alone. The outer fragments may be lifted into position if there is much deformity. The wound is tamponed with iodoform gauze for a few days until repair, takes place and all danger of infection has passed away. The patient should remain quietly in bed for the first few days and attention should be given to the digestive apparatus, as in any other surgical operation. If there is no great swelling, infection or pain in the wound, the gauze packing should remain in the wound for four or five days, when it may be removed and the wound allowed to heal.

Tumors of the Frontal Cells.—Tumors of the frontal cells may be malignant, benign or mixed and may be of local origin or due to an extension from contiguous structures. The malignant tumors which may occur in this region are sarcoma, carcinoma and mixed tumors.

Non-malignant tumors may be cyst, osteoma, myxoma or fibroma. The possibility of syphilis and tuberculosis as a cause of swelling of the frontal cells should not be overlooked.

Treatment.—The treatment in all cases of tumors depends somewhat upon the rapidity of the growth and the character of the tumor. Immediate removal of all structures is indicated in malignant growths. Non-malignant tumors may be dealt with according to the exigencies of the occasion. As a rule, all tumors of the frontal cells should be removed.

CHAPTER XXIII.

DISEASES OF THE ACCESSORY SINUSES OF THE NOSE (CONTINUED).—ETHMOID CELLS.

Acute Ethmoiditis.—Acute ethmoiditis is an acute inflammation of the mucous membrane lining the ethmoid cells.

Etiology and Pathology.—Acute inflammation of the ethmoid cells may be a primary or secondary involvement. The secondary form is due to extension of infection from a like condition of the nasal mucosa. The disease is one of the complications of measles, scarlet fever, typhoid fever and influenza. Edema of the nasal mucosa may bring about a closure of one or all of the ostia of the cells, producing acute retention of secretion.

In acute catarrhal inflammation, the mucous lining of the cells becomes swollen and congested, followed by a profuse serous exudation, which may become muco-purulent in character.

Symptomatology.—There is present headache, pain about the orbit, general or acute coryza, pain in the region of the sinuses when stooping over, slight rise of temperature, with often mental dullness. When there is marked retention of muco-purulent secretion the pain in the region of the sinuses, temples and forehead becomes excruciating. The discharge from the cavities varies in character with the severity of the disease from a thin mucus to a thick, creamy pus. The disease may be unilateral or bilateral.

Course and Prognosis.—The course of the disease usually varies in severity and may continue from one to two or three weeks. The symptoms gradually disappear and the swelling and nasal obstruction recede, the patency of the ostia is restored and free drainage is established with the recovery of the patient. There is always a tendency for the disease to become chronic.

Diagnosis.—The diagnosis usually depends upon the foregoing

symptoms. Upon inspection, the nasal cavity is usually hyperemic. The middle turbinate is swollen and impinges upon the septum, causing stenosis and otophonia.

Upon inspection, a sero-mucous discharge is seen filling the middle meatus and covering the middle turbinate. The secretion filling the middle meatus or olfactory cleft is a thin glistening mucus, changing in consistency as the disease advances.

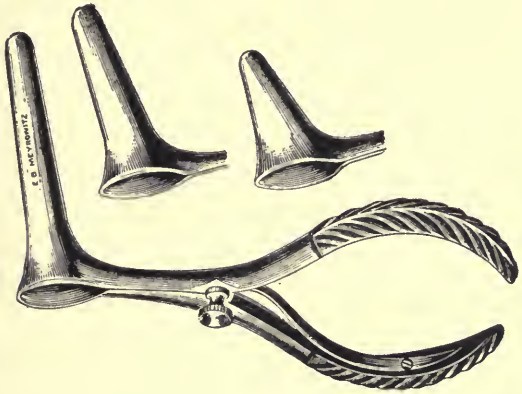

FIG. 123.—KILLIAN'S NASAL SPECULA.

Treatment.—The intra-nasal treatment varies but little from that of acute inflammation of the frontal cells. The swollen and congested condition of the middle turbinate can best be reduced with a two per cent. solution of cocain and adrenalin 1/3,000, dropped into the attic of the nasal cavity while the head is suspended over the end of a couch or table. This method of treatment should be repeated four or five times daily.

Where this plan of treatment is contra-indicated from age or other contingencies, the treatment consists in spraying the nose as high up into the attic as possible with a solution of adrenalin chlorid 1/5,000, followed by a warm alkaline spray. This should be repeated four or five times daily. In addition, the patient, if an adult, should be given ten grains of Dover's powders and one grain of

calomel at bed time, followed by a Seidlitz powder or Hunyadi water upon arising.

The pain from ethmoiditis depends a great deal upon the amount of exudation within the cells and the patency of the ostia. Where the pain becomes very severe, five grains of acetanilid compound and one-fourth grain sulphate of codein may be given the patient every three or four hours. Hot applications in the form of dry heat across the forehead and eyes will aid in alleviation of the congestion and pain.

On account of the tendency of the disease to recur, the patient should be warned against over-heating the body and sudden exposure to cold draughts of air. Hypertrophies of the middle turbinated body, polypi or any other intra-nasal malformation or catarrhal condition of the mucosa should be removed as soon as active symptoms of the disease have passed away.

Chronic Inflammation of the Ethmoid Cells.—Chronic inflammation of the ethmoidal cells is a chronic inflammation of the mucous membrane lining one or all the ethmoid cells.

Etiology.—The disease is more especially due to recurrent attacks of acute inflammation of the ethmoid cells and is often located in the posterior cells. The condition may also be due to chronic nasal catarrh, polypi, syphilis and tuberculosis. One of the important factors in the causation of the disease is imperfect drainage from hypertrophy of the middle turbinate which produces a lessened amount of atmospheric pressure in the attic of the nose, thus preventing necessary air pressure and free ventilation of the cells and physiological suction caused by currents of air passing uninterruptedly through the nose. The disease may sometimes involve the bony structure, according to Shirley, producing a necrosing ethmoiditis or ethmoiditis granulosa.

Pathology.—The pathology of the disease varies but slightly from that of chronic catarrhal rhinitis. There is a thickening of the whole structure of the mucous membrane with a rapid proliferation of mucus, broken-down epithelial cells and sometimes muco-pus. There is but a step from chronic muco-purulent inflammation of the ethmoid cells to purulent ethmoiditis.

Symptomatology.—The patient may complain of the constant accumulation of mucus in the posterior attic of the nose, necessitating hawking and expectorating. Accumulation of mucus may be from one or both sides of the nasal space. There is often an accumulation of thick mucus in the anterior attic of the nose, which, upon being blown from the nose, renders the attic of the nose patent for a short time.

The constant dropping from the post-nasal cavity is more often due to a catarrhal inflammation of the ethmoid cells. This may be especially demonstrated by the removal of the middle turbinate and the free drainage of the cells. In those cases in which local treatment had proven of no avail, the cause of the continual discharge will often be found to be located in the ethmoid cells. The secretion may flow down from the middle or lower turbinated bodies and from evaporation of watery constituents, form thick crusts in the attic and along the floor of the meatuses, which predispose to catarrhal inflammation of the nasal mucosa.

Diagnosis.—With the above enumeration of symptoms, the diagnosis is sometimes easily established. Where there is a necrosing ethmoiditis, the same may be discovered by first cocainizing the attic of the nose and afterward exploring with a slightly curved, blunt-pointed probe.

In posterior rhinoscopic examination, the discharge may sometimes be discovered emerging from the ethmo-sphenoidal recess and covering the lateral walls at the naso-pharyngeal junction.

On account of the anatomical position of the ethmoid cells is it frequently an impossibility to detect through the anterior nares secretion in the superior meatus. Secretions, however, from the anterior ethmoidal cells, draining into the middle meatus, may be often accurately differentiated as coming from the ethmoid cells.

Among the frequent eye complications of chronic ethmoiditis are asthenopia and pain behind the eyes, associated with periodical attacks of frontal headache.

Course and Prognosis.—The course of a chronic inflammation of the ethmoid cells is usually very slow. The great majority of these cases go undiagnosed and the patient receives treatment all the while

for a chronic catarrhal inflammation of the nasal mucosa. The probability of an early cure depends upon the surgical measures, that is, the removal of the middle turbinated body, the establishment of a free ventilation of the attic of the nose and uninterrupted drainage from the cells.

Treatment.—Local medication consists in spraying the anterior nares and irrigating the post-nasal space with a nasal douche, with Seiler's or Dobell's solution, twice daily. In mild catarrhal inflammation of the anterior ethmoid cells, tampons dipped in fifty per cent. ichthyol and equal parts of glycerin and water may be placed in the attic of the nose for one-half hour daily, followed by a spray of camphor and menthol in albolene.

In addition, tonics and alteratives are indicated according to the general condition of the patient.

Anterior hypertrophies of the middle turbinate or polypi should be removed. The presence of polypi in the superior meatus is frequently only discovered by removal of the anterior half of the middle turbinated body. After the removal of polypi from the region of the infundibulum and superior meatus, necrotic areas may frequently be discovered, which demand systematic curettement, followed by daily irrigation with a mild alkaline solution and direct application of fifty per cent. argyrol or fifty per cent. ichthyol on a cotton-tipped probe. This should be continued daily until recovery is complete.

Suppuration in the Ethmoidal Cells or Ethmoidal Sinusitis.—Ethmoidal sinusitis is an acute or chronic purulent inflammation of the mucous membrane lining one or all of the ethmoidal cells, originating in loco or by extension of infection from contiguous parts and may be unilateral or bilateral, closed or manifest.

Etiology.—The cause of acute purulent inflammation of the ethmoidal cells is some disturbance of the metabolism from infection from some pathogenic organism. Infection from the grip bacillus is probably the most frequent factor in the causation of the disease. Infection may be carried into the ethmoidal cells by irrigation with a douche and as suggested by Luc, may follow washing of the maxillary sinuses.

Intra-nasal surgery and the application of the galvano-cautery may be followed by infection, ending in acute, purulent sinusitis.

Because of the interference with free ventilation of the attic of the nose and drainage from the anterior ethmoid cells, hypertrophy of the middle turbinate is one factor in the causation of the disease.

Purulent inflammation of the frontal or sphenoidal cells may extend to and involve the ethmoidal cells. Infection may also follow from fracture or suppuration in the orbit.

The predisposing causes of the acute form of the disease are the same as for acute, catarrhal inflammation of the ethmoidal cells (see page 400).

The cause of chronic, purulent inflammation is a failure of the acute, purulent inflammation to undergo complete resolution or a gradual change of a chronic, catarrhal inflammation into a chronic purulent inflammation by the admixture of pathogenic organisms.

The predisposing causes are a lowering of the metabolism of the body from inherited or acquired disease, hypertrophy of the middle and lower turbinates, catarrhal inflammation of the nasal mucosa and polypi.

Pathology.—The pathology is the same as that of purulent inflammation of the frontal cells.

Symptomatology.—The symptoms of acute purulent inflammation of the ethmoid cells or closed suppuration are more profound than symptoms of latent or manifest empyema.

In closed suppuration we have all the symptoms of acute inflammation with a retention of pus. The pain is severe and deep-seated and may involve the entire face and is more especially directed to the forehead, posterior and inner angles of the eye. Photophobia may be present. There is mental dullness, otophonia, loss of sleep, constipation and rise of temperature. The symptoms continue until spontaneous rupture and free evacuation of pus takes place.

The symptoms of latent empyema vary in individuals and frequently resemble those of acute empyema.

There may be general mental depression, melancholia and a sensation of distension in the bridge of the nose. The patient complains of an offensive and disagreeable odor, which cannot be detected

by the physician. The discharge from the nose is variable in amount and character and may be muco-purulent or thick, creamy or yellow pus. There is often an accumulation of a muco-purulent substance in the post-nasal space, necessitating frequent hawking and expectorating.

Crusts frequently form in the attic or middle meatus of the nose and are blown from the nose as thick slugs. Sometimes, following the removal of the slugs, the patient complains of a foul odor and taste in the mouth.

Where we have accumulations of slugs of mucus with degeneration, there is usually loss of appetite, general debility, headache and insomnia. In the more advanced form of the disease, the patient may complain of pain in the ears, radiating to the temples and behind the eyes, especially at night. In chronic latent or closed empyema, the ethmoid cells may become extended, protruding into the inner angle of the eye, sometimes rupturing and forming fistulous openings through the upper or lower lid. At the same time, the cells may extend into the nasal cavity, completely occluding the nares. Under such circumstances, the cells periodically rupture and refile again. During the process of refilling, the patient suffers all the symptoms of acute sinusitis. Upon inspection of the anterior nares in manifest empyema, thick and yellowish pus from the anterior ethmoidal cells may be detected draining into the middle meatus. The drainage may be slow and in consequence, thick, yellowish crusts are formed. The crusts should be lifted gently with a probe and detached with the hope of detecting the origin of the pus. Sometimes with a blunt-pointed probe passed up into the middle meatus, pus may be observed flowing along the probe. If necrosis of bone is detected in this region the diagnosis is positively established of suppuration in the anterior cells.

It sometimes occurs that the middle turbinate is shrunken during the day, which permits of some degree of comfort in nasal breathing, but at night upon lying down it swells, impinges upon the septum and produces headache, difficult breathing and obstruction to the exit of pus from the sinuses. As soon as the patient is up and about, the tissue relaxes and pus begins to flow into the anterior or posterior nares.

Sargent F. Snow makes the assertion that eighty per cent. of the cases of *Tic Douloureux* are due to intra-nasal or sinus pressure. The number of cases dependent upon ethmoidal affection is of course conjectural, but is undoubtedly very large.

If the purulent discharge passes into the post-nasal space for a great length of time, infection with swelling of the mucous glands about the ostium tuba takes place, producing chronic salpingitis and catarrhal deafness.

Diagnosis.—The diagnosis of suppuration of the anterior and posterior ethmoid cells is not always an easy matter. There is usually

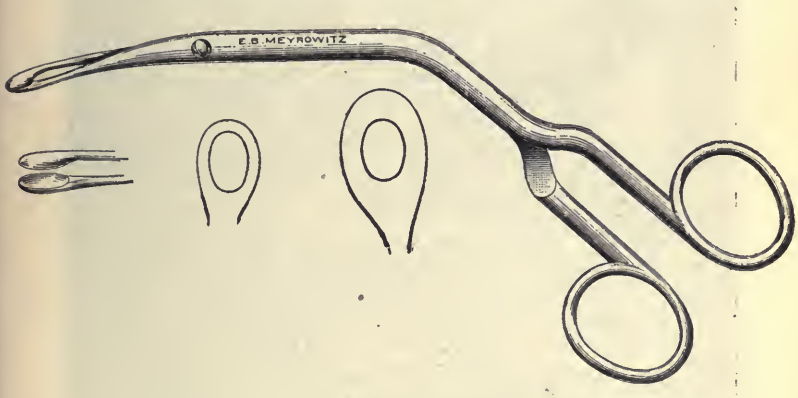

Fig. 124.—Luc's Middle Turbinate Forceps.

present a catarrhal inflammation of the nasal mucosa and as enumerated under symptoms of the disease, thick crusts form in the nasal cavity. These crusts are sometimes more apparent in the post-nasal space. Frequently the first evidence of chronic empyema in the anterior ethmoid cells is the presence of small polypi and granulating tissue springing from the region of the infundibulum. Upon removal of the polypi or granulations and exploration with a blunt-pointed probe, pus of a creamy consistency may be detected flowing from the anterior cells. Upon post-rhinoscopy, where the posterior cells are involved, pus will be observed draining backward from the middle meatus over the posterior portion of the middle turbinate

FIG. 125.—SAGITTAL SECTION OF HEAD.

1, Holmes's scissors in position for removal of the middle turbinated body; 2, lower turbinated body; 3, middle turbinated body; 4, superior turbinated body.

FIG. 126.—SAGITTAL SECTION OF HEAD.

1, Luc's forceps in position for removal of the middle turbinate, after cutting partially through with Holmes's scissors; 2, middle turbinated body; 3, superior turbinated body.

FIG. 127.—GRUENWALD PUNCH FORCEPS IN POSITION FOR THE REMOVAL OF THE POSTERIOR PORTION OF THE SUPERIOR TURBINATE AND POSTERIOR ETHMOIDAL CELL.

1, Gruenwald punch forceps; 2, posterior portion of the superior turbinated body; 3, showing the anterior portion of the superior turbinate removed, exposing the naso-frontal duct; 4, sphenoidal cell.

and along the lateral walls of the pharynx, sometimes covering the hood of the ostium tuba.

It is sometimes only possible to differentiate the disease upon removal of the middle turbinated bones. By so doing, the sphenoidal sinuses will be exposed for direct exploration and the presence and absence of pus in this region can be demonstrated. It is often possible without removing the middle turbinate, as shown in the illustration, to pass a curved cannula, shaped after that of the Eustachian catheter, directly into the sphenoidal sinuses, thus ascertaining the presence or absence of pus in this region (see directions for irrigating the sphenoidal cells). With the cannula in position, fluids or pus within the sinuses may be sucked out with a Politzer bag. Pus may be detected by the character of the secretion in the cannula or by microscopical examination.

Treatment.—The treatment of acute purulent inflammation of the ethmoidal sinuses is the same as that for acute serous inflammation in this region. The treatment of chronic empyema of all the cells is purely surgical and is directed to the establishment of free communication of the cells with the nasal cavity by converting the small cells into one large cavity.

In involvement of the anterior cells, polypi and necrosis of bone, the surgical treatment consists in the removal of the anterior end of the middle turbinate, as shown in the figure, removal of the polypi and curettement of the cells. If the disease is confined to this region alone, with the establishment of free drainage and systemic irrigation, recovery may be complete. If the middle meatus is wide and the middle turbinate narrow, it may sometimes be unnecessary to remove a portion of that body, curettement being usually accomplished without injury to the turbinated bone. In involvement of all of the cells, the middle turbinate is removed under local anesthesia with a five per cent. solution of cocain and 1/1,000 adrenalin chlorid. The nasal cavity is previously cleansed as for any internasal operation. (In referring to Fig. 125, Holmes's scissors are shown in position.) With the first cut of the scissors, the turbinated bone is partially severed from its attachment. The scissors are now withdrawn and a Luc forceps inserted as in Fig. 126, which grasps the

turbinate, and by gently twisting the entire turbinated bone is removed. Following the removal of the turbinated bone, the area of the operation is rendered free from hemorrhage with applications of cocain and adrenalin. The anterior cells are sometimes exposed in the first incision with the Holmes scissors and if not exposed at this time,

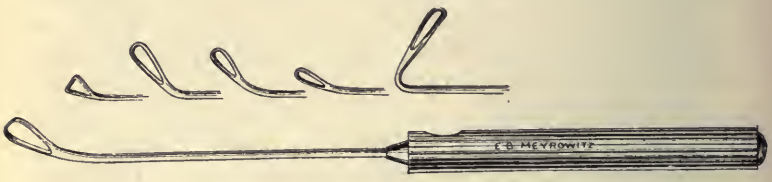

FIG. 128.—COAKLEY'S SINUS CURETTES.

they should be opened with a sharp curette. Following this, the Gruenwald punch forceps (Fig. 127) may be used for complete obliteration of the posterior ethmoidal and sphenoidal cell. Following the breaking down of the cells with a free communication of the nasal space, the cavity is freed of all myxomatous growths, hyper-

FIG. 129.—MYLES'S NASAL CUTTING FORCEPS.

trophies, granulations and necrotic bone by gentle curettement. The exposed cavity is now irrigated with a Dobell's solution and the patient put to bed with the instructions to spray the attic of the nose with iced Dobell's solution and 1/3,000 adrenalin chlorid every

hour for twelve hours, after which time he may be allowed to go about the room. After four or five days, the patient may take gentle exercise out of doors, with the nasal cavity protected with small plugs of cotton in the vestibule of the nose. The local treatment consists in spraying the attic of the nose and nasal cavity with a warm Dobell's solution and irrigating through the post-nasal space with the same solution. Purulent discharge may continue for some length of time after operation, though it gradually disappears with the healthy regeneration of the mucous membrane lining the cavity.

Neoplasms of the Ethmoidal Cells.—Neoplasms of the ethmoidal cells, on account of the frequency of the involvement of the ethmoidal cells over other accessory cavities, are not infrequently observed.

Tumors in the ethmoidal cells may be malignant, benign or mixed. Syphilitic granulomata are frequently observed involving the ethmoidal cells. Myxomatous growths, as mentioned before, are extremely frequent in this region and if not changing into malignant growths, induce malignancy by irritation.

Treatment.—The treatment of all growths of the ethmoidal cells is necessarily operative and consists in following out the well-known classical operative procedures. The technique differs but little from that of operations for empyema. In curettement of the ethmoid cells for syphilitic granuloma, general necrosis and tubercular infiltration, great care should be taken lest the brain cavity be exposed, predisposing to meningitis and brain abscess.

Syphilis of the Ethmoidal Cells.—Syphilis of the ethmoidal cells is more often a tertiary lesion and may extend from an ulceration in contiguous parts or originate primarily in the ethmoidal cells. On account of the frequency of inflammation in the ethmoidal cells, metabolism of the parts is reduced, and in consequence, tertiary lesions in this region are not infrequent.

Symptomatology.—The patient may complain for some time of nasal stenosis and of the symptoms of acute ethmoiditis. With the necrosis of bone, there is more or less purulent discharge from the nose and fetid odor which is easily detected. The patient may sometimes blow spicula of bone from the nose. There is usually

present a history of syphilis dating over a number of years. In young children the disease is usually purely congenital.

Diagnosis.—The disease is differentiated from chronic purulent inflammation of the ethmoidal cells by a history of syphilis and general symptoms of syphilis, either inherited or acquired. There is usually an offensive odor, which is not so conspicuous in simple, purulent inflammation of the ethmoid cells. With a cotton-tipped probe passed into the region of the ethmoid cells, necrotic bone is detected by the peculiar grating sensation imparted to the probe.

Treatment.—In addition to the general antisyphilitic treatment for necrotic bone, hypertrophies or polypi within the region of the sinuses should be removed. If the spicula are too large to be removed without injuring the contiguous parts, the bone should be broken with scissors or Gruenwald's punch forceps. The cavity should be afterwards irrigated once or twice daily with Dobell's solution and dusted with aristol. Recovery is usually uninterrupted under the constitutional treatment. When there is present a syphilitic granuloma, the cells should be directly curetted. For the curettement of the sinuses, local anesthesia from the effect of cocain is sufficient for the operation.

CHAPTER XXIV.

DISEASES OF THE ACCESSORY SINUSES OF THE NOSE (CONTINUED).—SPHENOIDAL CELLS.

Catarrhal Sphenoiditis.—Inflammation of the sphenoidal cells may be acute or chronic, unilateral or bilateral (see Fig. 127).

Etiology.—The cause of acute inflammation of the sphenoidal cells is often the same as that producing a like inflammation of the ethmoidal cells. From an attack of acute rhinitis, the mucous membrane of the sphenoidal ostium swells, closing the cavity, which causes a retention of secretion. The cause of chronic catarrhal inflammation is the same as for a like condition of the ethmoidal cells. Among the predisposing factors of the disease are syphilis and tuberculosis.

Pathology.—The pathology varies in no wise from that of acute or chronic catarrhal inflammation of the ethmoidal cells.

Diagnosis.—The diagnosis of catarrhal sphenoidal inflammation is exceedingly difficult and is frequently overlooked. In acute catarrhal inflammation with retention of secretion, there may be pain behind the eyes, radiating to the ears, photophobia and symptoms of a post-nasal catarrh, dropping from the post-nasal space or from either the sphenoidal or ethmoidal cells. Catarrhal exudation from the sphenoidal cells, because of the anatomical structure and movements of the pharyngeal muscles in swallowing, flows with greater facility toward the median line of the pharynx than secretion from the posterior ethmoidal cells, which more naturally drains along the lateral walls of the naso-pharynx. The presence of chronic catarrhal inflammation may sometimes be established by catheterization.

Periodical attacks of headache, deep-seated and reflected to the occiput, with dread of light, are highly suggestive of retention of secretion in the sphenoidal cells.

Treatment.—The local treatment of acute inflammation is the same as for acute rhinitis. The region of the sphenoidal ostia should be sprayed with a five per cent. solution of cocain, followed by adrenalin chlorid, 1/5,000. Argentum nitrate in a strength of from ten to fifteen grains to the ounce or a fifty per cent. solution argyrol, should be applied to the mucous membrane about the ostia with a curved, cotton-tipped probe. The post-nasal space should be irrigated twice daily with a warm Dobell's solution in the post-nasal douche.

The general treatment consists in flushing the bowels with Dorsey's mixture or magnesia sulphate, followed by large doses of salicylate of soda.

The treatment of chronic catarrhal inflammation consists in irrigating with a warm alkaline solution every two or three days. In case a chronic sphenoidal inflammation is suspected and the cavity cannot be reached with a cannula, the middle turbinate should be removed in its entirety, thus permitting direct therapy under the guidance of the eye. The presence of polypi or granulation tissue in the region of the ostium indicates necrosis of the cells and necessitates curettement.

Acute Empyema.—*Etiology.*—Acute empyema of the sphenoidal cells is an acute purulent inflammation of the muco-periosteal lining of one or both cells and is due to some pathogenic infection. The causes are both predisposing and exciting.

The predisposing causes are syphilitic and tubercular diathesis, exanthematous diseases, influenza, typhoid fever, acute naso-pharyngeal catarrh and purulent inflammation of the posterior ethmoidal cells.

The exciting cause is some pathogenic microörganism, especially the pneumococcus.

Pathology.—The pathology is the same as that for any other mucous membrane inflammation. On account of the complete aëration of the cells from a comparatively large ostium and close apposition of the nasal mucous membrane to the bone, inflammation of the sphenoidal sinus is less frequent than the frontal or ethmoidal cells. There may be a natural tissue resistance to infection, nature's compensation for the anatomical situation of the sphenoidal ostium.

Symptomatology.—In acute sphenoidal empyema, the patient may complain of severe coryza, sudden pain in the top of the head, radiating to the front of the ear and side of the face on one or both sides, dizziness, rise of temperature, constipation, and sometimes nausea, vomiting and delirium. The pain in the ears may resemble that of acute otitis media or *Tic Douloureux*. There may be present a dread of light, sometimes optic neuritis, and the patient remains closed in a darkened room. There may be pain of a deep, boring character back of the eyes. The symptoms of pain continue until there is spontaneous rupture into the spheno-ethmoidal recess and a free flow of pus.

Diagnosis.—The diagnosis of acute purulent sphenoiditis depends, to a great extent, upon the above enumeration of symptoms, which readily suggest the region affected. Acute inflammation of the ethmoidal cells resembles in symptomatology sphenoidal inflammation, but can usually be differentiated after ocular inspection of the nasal cavity and shrinkage of any intranasal hypertrophies. Acute retention of pus in one or both sphenoidal cells is very difficult to detect, unless effort is made to enter the sinus with a cannula, followed by irrigation. After spontaneous rupture and discharge of pus, the same may be detected with rhinoscopic mirror, flowing from the region of the spheno-ostium and near the median line. In suspected cases of sphenoidal involvement, irrigation of the cells should be attempted. With the relief of the symptoms following irrigation, the diagnosis is established. Frequently the disease may establish itself at short intervals, demanding a number of irrigations.

Course and Prognosis.—The course of acute, purulent sphenoiditis is exceedingly slow on account of the anatomical position of the ostium and imperfect drainage. The disease has a tendency to become chronic.

Treatment.—The treatment is the same as for acute purulent ethmoiditis. Attention is first directed to securing free evacuation of the bowels and free aëration of the attic of the nose by the shrinkage of any enlarged middle and lower turbinates. With free ventilation of the nasal cavity, spontaneous evacuation of the sphenoidal cells is a natural condition.

For the relief of the pain in the region of the sphenoid and along the course of the tri-facial nerve, codein in one-fourth grain doses combined with aspirin in five to ten grain doses may be given every three hours. Hot foot-baths should be given two or three times daily. Warm nasal douche of Dobell's or Seiler's solution should be ordered twice or three times daily. Once daily, the region of the sphenoidal ostium should be cocainized and argentum nitrate, twenty grains to the ounce, applied with a curved cotton-tipped probe passed through the nasal cavity.

With the discharge of pus and a continuation of pain, the sinus should be irrigated through a Freeman cannula, once daily, with a mild alkaline and antiseptic solution.

Any constitutional cachexia should be corrected by alteratives and tonics.

Purulent inflammation of the ethmoidal cells that may be a contributing factor to the disease should be corrected by the removal of the middle turbinate, establishment of free drainage and the removal of any diseased tissue.

Chronic Empyema.—*Etiology.*—A chronic purulent inflammation of the sphenoid cells may be unilateral or bilateral and is often due to an acute purulent inflammation.

Pathology.—There is a destruction of the muco-periosteal lining of the cells, either partial or complete, with sometimes the formation of granulation tissue and polypi. With the destruction of tissue by odor-producing bacteria, a condition of ozena sphenoidalis is brought about. The staphylococcus and pneumococcus may also be present.

On account of the slow process of necrosis in the bone, and thinness of the superior walls of the sinus, there is a grave tendency to the formation of a brain abscess, optic neuritis or anesthesia due to disease of the spheno-palatine ganglion.

Symptomatology.—Recurrent attacks of the retention of pus in the sphenoidal cells give rise to the symptoms of exacerbation of acute purulent sphenoiditis. Exacerbations of attacks of *Tic Douloureux* and ozena may frequently be traced to sphenoidal involvement.

The discharge of pus from the post-nasal space resembles the

symptoms of post-nasal catarrh and may, unless a very careful inspection is made, be mistaken for post-nasal catarrh. Crusts may form in one or both sides of the nose, high up in the channel, from the accumulation of mucus and pus and the evaporation of watery contingents.

The character of pain varies in individuals and may be that of a dull headache or a sensation of dullness of the head and intellect. In exacerbations of the disease, the pain may become harrowing in the extreme. The location of the pain may be in the vertex, radiating to the front of the ear and sometimes along the inferior dental nerve. Pain may also involve the back of the neck and the general course of the tri-facial nerve.

Periodical attacks of headache with a naso-pharyngeal catarrh, in the absence of a cause, should always suggest sphenoidal sinusitis.

The ocular lesions which may accompany the disease are asthenopia, ocular headache, retinal hyperesthesia and often retrobulbar neuritis, followed by partial or complete atrophy. Suppuration of the sphenoidal cells may bring about necrosis of the roof of the cells, producing septic meningitis. In extension to the sphenoidal fissure, paralysis of the motor-oculi nerve may occur.

Diagnosis.—The discharge of bright yellow pus into the post-nasal space and accumulation of scabs in the post-nasal space with the enumeration of the above symptoms, are strongly suggestive of sphenoiditis. Pus due to Thornwaldt's disease can usually be easily differentiated by post-rhinoscopic examination. The pocket or fistulous opening in the vault of the pharynx, described by Thornwaldt, can be detected under good illumination, with a curved probe passed behind the soft palate. Direct examination of the contents of the sphenoidal cells may sometimes be made by cocainizing the nasal cavity with a strong solution of cocain and adrenalin chlorid, cleansing of all crusts and exudations and passing a flexible silver cannula approximately the size of a No. 1 Eustachian catheter with a reversed curve necessary for insertion into the frontal cells. With the mucous membrane thoroughly anesthetized, the oiled cannula is passed into the attic of the nose between the middle turbinate

and septum. In this position, it is gradually pressed backward and downward successively until it is felt to enter the sinus. When once in position, there is a resistance to further downward movement with a freedom of lateral movement. As the cannula impinges upon the lateral wall, there is a sensation of striking bare bone. With a compressed Politzer bag in the cavity, pus or the contents of the sinuses may be sucked into the cannula. According to Gruenwald, the average distance of the sphenoidal sinus from the entrance of the nose is, in female adults, 7.6 cm., males, 8.2 cm.

Course and Prognosis.—The course and prognosis depends upon the detection of the disease, successful irrigation, or if the exigency of the case demands, breaking down the anterior wall with the free exposure of the cells and curettement of granulations and polypi.

Treatment.—Where irrigation and catheterization are possible, relief of all symptoms may quickly follow. For the free exposure of the sphenoidal ostium, the entire middle turbinate should be removed. This once done, the irrigation and even the destruction of the anterior wall are, comparatively speaking, easy. For irrigation, a warm Dobell's solution is well borne. This should be repeated once daily until pus has disappeared. Gruenwald's punch forceps may be used for destruction of the anterior wall. If the ostium cannot be entered with the upper jaw of the forceps, a curette may be used for enlarging the opening, which may then be entered with Gruenwald's forceps. The wound may be packed with iodoform gauze, which is removed the following day and the wound irrigated with warm Dobell's solution. Subsequent packing is unnecessary. The time necessary for complete recovery is variable, usually extending over a number of weeks. The nasal cavity should be frequently sprayed with a warm alkaline and antiseptic solution. Tonics and alteratives are frequently indicated.

CHAPTER XXV.

DISEASES OF THE ACCESSORY SINUSES OF THE NOSE (CONTINUED).—MAXILLARY ANTRUM OR ANTRUM OF HIGHMORE.

Acute Catarrhal Inflammation of the Antrum of Highmore.—Acute catarrhal inflammation of the antrum of Highmore is a simple serous inflammation of the muco-periosteum lining the antrum of Highmore, occurring independently or coincidently with a general inflammation of the mucous membrane of the nasal cavity, producing closure of the ostia, and imperfect ventilation and drainage.

Etiology.—The causes are both predisposing and exciting. The predisposing causes are acute or chronic rhinitis, diphtheria, scarlet fever, measles and diseases of the teeth, especially those with the roots in close proximity to the floor of the antrum. The exciting cause is some form of infection, especially the grip bacillus.

Symptomatology.—There is usually a history of acute rhinitis and pain in the region of the antrum, extending into the nose and angle of the jaw. There may be headache and some tenderness upon pressure in the canine fossa. The cheek of the affected side is frequently swollen. The discharge from this nasal cavity sometimes produces smarting and burning about the meatus of the nose. If the affection is due to diseased teeth, there may be pain and redness in the region of the tooth.

Diagnosis.—With the enumeration of the above symptoms the diagnosis is usually simple. There is seldom any shadow to be detected upon transillumination. The nasal cavity of the affected side is observed to be congested. The middle turbinated body is swollen and impinges upon the lateral wall. There is usually little or no discharge to be detected coming from the region of the ostium.

Treatment.—The general treatment is directed to the restoration

of the general metabolism. In those cases caused by uric acid diathesis, all meats and alcoholic liquors should be interdicted. The patient should avoid exposure to cold and damp weather and be warned against the general conditions predisposing to acute catarrhal inflammation. The bowels should be flushed with a saline and the patient given salicylate or benzoate of soda or aspirin in ten grain doses, three times daily.

The local treatment by the physician consists in applying a five per cent. solution of cocain and 1/5,000 adrenalin solution to the middle meatus. Following this, the nasal cavity should be thoroughly cleansed by spraying with a mild, alkaline, antiseptic solution. A fifty per cent. solution of argyrol should be applied to the region of the ostium with a cotton-tipped probe. In the absence of argyrol, a solution of nitrate of silver, ten to fifteen grains to the ounce, should be substituted. The object of the local treatment is to reduce the engorged condition of the mucous membrane around the ostium. The nose is then sprayed with a two per cent. solution of camphor and menthol in albolene. The patient should be instructed to cleanse the nose with a Dobell's or Seiler's solution, three times daily, before meals. Hot applications in the form of a hot-water bag should be applied to the region of the antrum for one-half hour, morning, noon, night and bed time.

The disease tends to recovery and seldom becomes chronic. Where there is very great accumulation of mucus, and pain from pressure, it may be necessary to perform an exploratory puncture and irrigate the sinuses with warm saturated solution of boracic acid.

Chronic Catarrhal Inflammation of the Antrum of Highmore.—*Etiology.*—The disease is more often due to successive attacks of acute catarrhal inflammation, typhoid fever, influenza or a general dyscrasia.

Pathology.—There is a hypertrophy of the muco-periosteal lining of the antrum with frequent destruction of bone structure, and in consequence, there are frequently observed in the antrum, polypi, cysts, granulation tissue and thick mucus or muco-purulent exudation.

Symptomatology.—The patient complains of periodical attacks of pain in the region of the antrum and a thick, stringy mucus

or muco-purulent discharge from the nose. Exposure to damp weather may intensify the local symptoms. The odor from the breath is frequently very sour and offensive and is due to necrosis of bone and mucous membrane.

There is usually present some anaërobic bacteria which produce a condition known as ozena of the antrum. The disease is more often encountered in patients past the middle age of life.

Diagnosis.—The diagnosis is by a process of exclusion. Transillumination may show a darkened area in the region of the antrum. An exploratory puncture should be made through the inferior meatus, with a Myles trocar in all suspected cases of antrum involvement. The lateral wall should be anesthetized with a ten per cent. solution of cocain, and entire nasal cavity carefully cleansed by irrigating with Dobell's solution. Following the introduction of the sterile trocar, the cavity should be irrigated with a warm boracic acid solution and the character of the secretion carefully noted. If possible, the presence of polypi should early be detected and removed because of the tendency to produce some malignant neoplasm by a process of irritation.

Treatment.—The treatment in chronic catarrhal inflammation should be, if possible, irrigation through the natural opening with a warm saturated solution of boracic acid. The instrument devised by Killian, is highly efficacious for irrigating through the natural opening. Where irrigation through the natural opening cannot be done, the treatment is surgical and consists in puncturing the antrum through the inferior meatus with a large Krause's trocar and irrigating with a warm Dobell's solution. By using a large trocar, the wound stays open for a longer time and the perforation is sufficiently long to admit of easy and painless irrigation. Diseased teeth in the region of the floor of the antrum should be removed.

The general treatment is directed to the building up of the system and the correction of any dyscrasia.

Acute Purulent Inflammation of the Antrum of Highmore.—*Etiology.*—The causes of acute purulent inflammation of the antrum of Highmore are both predisposing and exciting.

The predisposing causes are acute coryza, which brings about edema of the mucous membrane and closure of the ostium maxillæ, diseases of the teeth, purulent inflammation of the frontal or ethmoidal sinuses, polypi, exanthematous diseases and any nasal obstruction which may interfere with the free drainage into the middle meatus from the antrum.

The exciting cause is infection from some pathogenic organism, more especially the grip bacillus, which may find entrance into the antrum by way of the ostium, blood or lymph stream from suppuration in contiguous parts.

Pathology.—The antrum of Highmore, being covered with pseudo-stratified columna ciliated epithelium containing goblet cells, with a vascular supply, is predisposed to extension of infection from the nasal mucosa or the superior maxillary bone. The secretion following the venous congestion or active inflammation may become infected by pyogenic organisms, such as pneumococcus, streptococcus and bacillus of influenza. The disease may occur at any age.

Symptomatology.—The patient complains of pain in the face in the region of the antrum, extending to the inner angle of the eye, to the temples and sometimes involving the whole side of the face. With the increase of exudation within the antrum, the pain increases in intensity until free evacuation takes place spontaneously or by operative measures. There is sometimes a sensation of fullness in the roof of the mouth and tenderness upon palpation, the sounds produced by palpation being not so distinct as upon the well side. The pain may be so great at night as to prevent sleeping and in consequence, the general vitality of the system becomes rapidly reduced. The patient's painful symptoms at night are somewhat relieved by sitting up or being propped up in bed. The amount of secretion from the nose is variable. If there is a patency of the ostium, creamy pus is poured out into the meatus and may be expectorated or blown from the nose. The amount of pus blown from the nose in the morning exceeds that of any other time of the day. A great deal of pus drains back into the throat after arising.

The avenue of spontaneous rupture is usually through the natural opening, though the cavity has been known to rupture through the

canine fossa, the orbit and the ethmoidal cells and infiltrate the alveolar process, producing a complete necrosis of the affected side. During the active stage of inflammation, there may be a slight rise of temperature and general lassitude.

Diagnosis.—Pain in the region of the maxillary antrum with a discharge of pus from the nose is suggestive of antrum disease. Upon palpation, there is a tenderness, and the sounds of palpation are more distinct on the affected side. The tuning fork C, when applied to the diseased antrum is less distinctly heard than on the opposite side. There is usually tenderness along the alveolar process especially where there is disease of the teeth. There may be a history of toothache, the cavity in the tooth pointing directly to the tooth as an exciting cause of the inflammation. Previous to examination of the nasal cavity, the nose should be sprayed with a five per cent. solution of cocain and adrenalin, 1/5,000 and cleansed of all secretion and exudation.

Pus from the maxillary antrum is usually pure white or yellowish-white in appearance and can be detected pouring out into the middle meatus and is sometimes detected at the anterior edge of the middle turbinated bone about the median line, differing in this respect from that of both the frontal and ethmoidal cells, which makes its appearance in the attic of the meatus and the juncture of the bone and lateral wall. Upon wiping the pus away and watching intently for a few seconds, fresh pus can be detected pouring out into the region of the ostium maxillary. Sometimes by closing the anterior nares with the finger and making deep suction from the nose, great quantities of pus may be drawn into the middle meatus. Where there is doubt as to the existence of pus, puncturing though the middle meatus with a Killian trocar and flushing the antrum with a mild normal salt solution will demonstrate its presence or absence. Pus will sometimes flow from the trocar, drop by drop. Where the pus is very thick, however, it is necessary to irrigate the cavity through the trocar. If pus is present, it will usually be observed flowing from the nose.

Prognosis.—The prognosis of simple uncomplicated purulent inflammation of the antrum is usually very good. As in any other pus

cavity, if the foci of infection can be removed, the recovery is usually very rapid.

Treatment.—The treatment is both constitutional and local. The constitutional treatment consists in building up the system and the correction of any dyscrasia which may be detected. Any diseased teeth should be removed.

The local treatment consists in puncturing the antrum with a Krause's trocar high up in the inferior meatus and irrigating with one-half of one per cent. solution of lysol or warm Dobell's solution. The cavity should be irrigated once daily through a small cannula which can be easily passed through the opening made by the trocar, into the antrum. This form of treatment should be continued until all evidence of pus has passed away. The time of treatment varies from ten days to two weeks. The symptoms of pain and distress pass away immediately upon puncturing and the evacuation of pus. After the disease is cured, hypertrophies or any obstructions about the maxillary ostia should be removed. If the middle turbinated bone is large and impinges upon the lateral wall and septum, it should be removed in its entirety. Subsequent treatment consists in treating any catarrhal condition of the nasal mucosa.

Chronic Purulent Inflammation of the Antrum of Highmore or Empyema of the Antrum.—*Etiology.*—The causes of chronic purulent inflammation of the antrum of Highmore are recurrent attacks of acute inflammation, acute purulent inflammation which has failed to recover, chronic catarrhal inflammation of the antrum, chronic catarrhal or purulent inflammation of the frontal and ethmoidal cells, diseased teeth, hypertrophies of the middle turbinate, deviations of the septum producing a purulent periostitis, influenza and syphilis.

Pathology.—There is usually more or less destruction of the muco-periosteal lining of the antrum with sometimes involvement of bone with the formation of polypi and cysts. There may be infection from the aërobic or anaërobic bacteria, producing a foul odor and pus. Changes in the bone structures, in consequence of a long-continued discharge, are somewhat variable. The condition of rarefying otitis may be brought about. Sometimes new bone, forming thin plates,

described by Bosworth, may be thrown out in such a way as to divide the antrum into small chambers.

Symptomatology.—The patient complains of a dropping in the throat, nasal obstruction and ill-smelling discharge from the nose. Acute exacerbations of a chronic empyema may occur, producing pain and involvement in the region of the antrum. Foul and offensive discharge is usually greater in the morning than at any other time of the day. There may be present a history of disease of the proximal teeth. The color of the pus is usually a creamy white. The character of the pain in chronic empyema is somewhat variable and may be present in a very mild form in involvement of the teeth.

Diagnosis.—A chronic purulent discharge from the middle meatus is usually suggestive of antrum disease. The pus is usually observed at the lower or anterior border of the middle turbinate. With the mucous membrane of the nasal wall shrunken by cocain and adrenalin, the pus, when wiped away, may be seen to rapidly re-accumulate at this point, and with the patient holding the head well forward and downward, in a few seconds the pus is noted to drain anteriorly. Where the pus is retained for any length of time, it may take on the odor of sulphuretted hydrogen. A tuning fork is heard less distinctly, as pointed out by Kuyk, than on the well side. By transillumination, a distinct shadow on the affected side is usually obtainable. By pressing a rubber-hooded lamp over the maxillary process, a shadow may sometimes be detected through the open mouth.

The diagnosis may be accurately established by puncturing with a Myles' or Krause's trocar through the inferior meatus, or puncturing the middle meatus with a Killian trocar, and flushing the cavity with a warm, mild antiseptic solution. I believe it better to puncture with a large trocar, giving the patient the advantage of easy subsequent irrigations, and besides, if it is found necessary to operate more extensively, dissection of the internasal wall of the inferior meatus, which is recommended by Holbrook Curtis, may be readily performed. If either the first or second molar tooth is diseased, it should be extracted and the cavity inspected for pus.

Prognosis.—The prognosis is exceedingly variable and depends upon the length of time the disease has existed, the general necrotic

condition of the antrum and the thoroughness of any operative procedure. Metastatic abscess may exceptionally follow radical operative measures, usually ending in the death of the individual. The Kuster and Caldwell-Luc operations predispose to metastasis more than internasal operations.

Treatment.—The treatment is both intra- and extra-nasal. The intra-nasal treatment consists in either puncturing through the internal wall of the antrum into the inferior meatus of the nose with a large Krause's trocar, subsequent daily irrigation with a lysol solution, one-half of one per cent., or a weak solution of permanganate of potassium. If this procedure is not satisfactory and the disease is not due to any carious tooth, the operation, recommended by Holbrook Curtis, of removing a button from the internal wall of the antrum in the inferior meatus and by a previous removal of the anterior portion of the inferior turbinated bone, curettement and drainage may be performed (see Fig. 130).

The technique of the operation, as recommended by Curtis, is as follows:

"The inferior meatus is packed with a pledget of absorbent cotton, saturated with a half-and-half solution of cocain ten per cent. and adrenalin chlorid solution (1/1,000). The inferior turbinate is covered externally and internally from its middle portion anteriorly. It is a good plan to fortify the patient with an ounce of whisky, 1/25 gr. strychnia sulph. and 1/15 gr. digitalin, before operating. After the cotton has remained in contact with the turbinate and external wall of the meatus for ten minutes, we take a 1/8–3/16 in. trephine, run by an electric motor or dental engine and remove by a couple of perforations, followed by the cutting forceps and snare, the anterior third of the inferior turbinate. In this manner, we clear away the body to its line of insertion. The procedure is almost bloodless. The outer wall of the meatus is now brought into view. It will be seen that the trephine may be employed to perforate the inner wall of the antrum about a centimeter beyond the anterior point of attachment of the inferior turbinate just removed, the shaft of the trephine entering the nostril at an angle of about 45°. I prefer to make the perforation at a point a quarter of an inch above the nasal floor, for

the bone is thinner as we ascend the wall. Having punctured the antrum, we immediately change the trephine for an olivary or barrel burr drill and enlarge the orifice upward, downward and backward. We then stuff into the orifice some gauze wet with adrenalin solution, 1/5,000, which quickly stops any bleeding which may occur. By using properly curved flexible ring curettes, we are enabled to reach

FIG. 130.—SHOWING PERFORATION COMPLETED FOR RADICAL ANTRUM OPERATION THROUGH THE INFERIOR MEATUS. (After *Holbrook Curtis.*)

the walls of the antrum very satisfactorily. The bleeding does not annoy the patient as the head is so held that it escapes anteriorly. Orthoform or cocain may be used to limit pain or, if we so decide, the curetting may be postponed until another day" (*The Laryngoscope*, October, 1903).

On account of the inability to reach the cause by intra-nasal operations, extra-nasal operations for chronic suppuration of the antrum

of Highmore are recommended and are known as the alveolar, palatal, Kuster, Caldwell-Luc and Jansen operations.

The first two are the least scientific. The alveolar operation consists in opening through the root of an extracted tooth with a dental burr or ordinary hand drill and irrigating daily with some antiseptic solution. The wound is kept open with antiseptic gauze or antrum drainage tube. The disadvantages of opening through the alveolar process are the constant leakage of pus into the oral cavity, the infection of the gastro-intestinal tract and general constitutional disturbances. There is also a greater danger of bacteria from the mouth reaching the antrum, bringing about a mixed infection.

The palatal operation consists in opening through the roof of the mouth into the antrum. On account of the possible various malformations of the antrum and deviations into the chambers, the operation, unless there already exists a fistulous opening, which is indeed a rare condition, is never indicated.

The Kuster operation consists in making an opening through the external wall in the canine fossa large enough to admit the little finger. The incision is made under chloroform narcosis and antiseptic precautions at the gingivo-labial juncture in the canine fossa down to the periosteum and the tissues are resected back. The mouth is tamponed with gauze for the prevention of hemorrhage entering the larynx. With a gouge, mallet and Rongeur bone forceps, the outer wall is partially removed. With the aid of a head mirror, the operation permits the exploration of the cavity and the removal of areas of granulation tissue, polypi and necrotic bone by curettement. New chambers should be carefully sought for and removed. The cavity is thoroughly irrigated with one-half of one per cent. lysol solution, dried and mopped with pure carbolic acid. The cavity is firmly packed with iodoform gauze. The end of the gauze is allowed to protrude into the gingivo-labial incision for the prevention of closure of the wound. After five or six days, the gauze is removed and the cavity cleansed and repacked. If there is much secretion at the second dressing, the wound should be irrigated and repacked daily until complete recovery ensues.

The Caldwell-Luc operation consists in opening through the canine

fossa as in the Kuster operation with a counter-opening in the inferior meatus of the nose. After completion of the Kuster operation, the anterior two-thirds of the inferior turbinated body is removed through the nares and the internal wall of the antrum is removed with the electro-motor burr and biting forceps. After a portion of the internal wall is removed, the nose is thoroughly cleansed of all debris and the antrum cavity again plugged. The end of the dressing protrudes into the nose. The lips of the primary wound in the gingivo-labial tissue are brought together by stitches, thus entirely closing the external wound. All the subsequent dressings are thus carried through the antro-nasal wound. The advantage claimed for this operation is the complete thoroughness to be obtained by the operation and the lessened possibility of mixed infection. The persistance of suppuration following the radical operative procedure outlined, is suggestive of ethmoidal, frontal and sphenoidal involvement.

Jansen claims that when one sinus is involved, all the sinuses on that side are also affected and in consequence, he has devised and practices the radical operation of opening all the sinuses at one operation. Under antiseptic precautions and general anesthesia, the incision is made as in the Kuster or Caldwell-Luc operation, commencing behind the first molar tooth and extending as far as the canine region. The periosteum is elevated and the external wall is removed with chisel and Rongeur's forceps. The muco-periosteal lining of the antrum is entirely freed of all granulations, polypi, etc. The internal wall is carefully removed and with it the inferior and middle turbinated bones, leaving the mucous membrane of the nose intact. A tongue-shaped flap is made in the mucous membrane by an incision from the posterior extremity of the floor of the antrum forward to the anterior insertion of the turbinated bone. A second incision is carried from the beginning of the first incision upward and externally; the tongue formed is drawn forward into the antrum cavity and stitched to the buccal membrane at the median extremity of the gingivo-labial incision. The middle and posterior ethmoidal cells and sphenoidal cells of this side are now entirely curetted away. The entire wound is packed with iodoform gauze. The gingivo-labial wound may or may not be

closed according to the amount and severity of the suppuration. If the gingivo-labial incision is allowed to remain open, a strip of gauze protrudes into the mouth as in the Kuster operation. If the wound is closed, the gauze extends into the nasal cavity as in the Caldwell-Luc operation. The packing should remain in the antrum and ethmoidal cells for five or six days, when it is removed and replaced with fresh gauze. If there is some little pus discharge, I believe it better to moisten the gauze previous to insertion in the wound, with peroxid of hydrogen. The treatment should be continued until the suppurative condition has completely passed away.

Foreign Bodies in the Antrum.—Animate or inanimate objects may be found in the antrum. As in the frontal cells, insects and their larva may find entrance through the natural opening into the antrum. Inanimate substances may be driven into the antrum by a blow, fall, gunshot wound, dental manipulation or operative procedure on the antrum. Animate objects may be removed by puncturing with a Krause's trocar and irrigating with a warm, mild, antiseptic solution. In case the insects are not entirely removed and the purulent discharge persists, the Kuster operation is indicated. A history of injury and exploration of the wound will lead to detection of any inanimate substances in the antrum. On account of the constant secretion which takes place in the antrum, foreign bodies often bring about infection and a chronic purulent inflammation of the mucous membrane necessitates their early removal.

Mucocele of the Antrum of Highmore.—Mucocele of the antrum of Highmore is, as in mucocele of the frontal cells, due to serous exudation from the mucous membrane which is prevented from escaping by closure of the natural opening.

Etiology.—The disease is due to chronic catarrhal inflammation of the mucous membrane of the antrum and is observed more especially in those past middle age.

Symptomatology.—The symptoms are those of acute purulent inflammation of the antrum with a retention of secretion.

Diagnosis.—The patient complains of pain in the region of the antrum without the characteristic purulent discharge from the nose

as observed in acute empyema. Upon puncturing with a Krause's trocar, a straw-colored fluid is washed away.

Treatment.—The wound should be irrigated daily through the opening made with the trocar, with one-half of one per cent. solution of lysol until all symptoms of the disease have passed away. Where there are diseased teeth or suspected involvement from diseased teeth, the alveolar operation may be performed for the removal of the cyst contents and subsequent irrigation, rather than the intranasal operation.

Tumors of the Antrum of Highmore.—Tumors of the antrum of Highmore may be malignant, non-malignant or mixed. Malignant growths of the antrum may be primary or secondary (see Pathology of Malignant Growths). Primary growths may be due to irritation produced by the presence of myxomatous growths, granulations, osteoma, trauma, and predisposition to the disease. Non-malignant growths are more often due to the irritation of a chronic catarrh of the mucosa.

Diagnosis.—The presence of a tumor in the maxillary antrum may be suspected whenever there is continued pain. Upon transillumination, there is a dark area as in retention of pus. There may also be present myxomatous growths in the nasal cavity and disease about the natural opening of the antrum. Where the alveolar process is softened and infiltrated from the disease, the teeth loosen and are extracted by the patient. The disease, whether malignant or non-malignant, must be differentiated from chronic purulent inflammation, neuralgia, cyst and syphilis.

Treatment.—The treatment may be governed somewhat by the symptoms of the disease. In suspected tumors, the antrum should be opened through the canine fossa as in the Kuster operation and explored. Non-malignant tumors may be curetted or chiseled away and the wound packed with gauze. The subsequent treatment is the same as for chronic purulent inflammation. If a malignant growth is diagnosed, microscopical examination of the tissue removed and total resection of the upper jaw of the affected side is indicated.

Epitheliomatous or sarcomatous growths may not alone confine

themselves to the antrum, but may involve the ethmoid cells and alveolar process; in consequence, operative measures must be the most radical in character and consist in the partial or complete extirpation of the upper maxilla of the diseased side. This operation, in the nature of things, must come within the domain of the rhinologist and will therefore be referred to in detail.

For this operation, the following instruments are necessary: scalpel, straight and curved scissors, bone forceps, lion-jaw forceps,

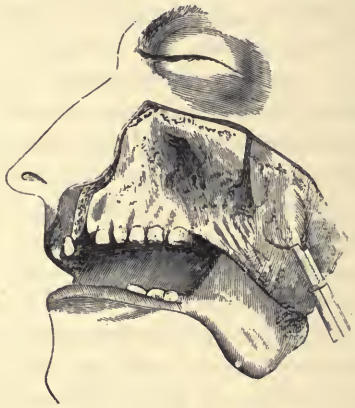

FIG. 131.—REMOVAL OF UPPER JAW.—Early stage. (After *Jacobson and Steward.*) Reflection of the flap and section of the bones.

straight nasal saw, Rongeur forceps, chisel, hammer, multiple number of artery forceps, needle and thread, tracheotomy tube and Paquelin's cautery.

Chloroform is usually indicated for narcosis. Previous to operation, the patient is especially prepared, if a man, by having the face and neck closely shaved. The mouth and teeth are cleansed and nasal cavity freed of as much debris as possible by frequently spraying with Dobell's solution.

On account of the involvement of the accessory sinuses whether from necrosis or extension of growth in some cases, it is quite impossible to secure anything like cleanliness of the nasal cavity. If

polypoid growths are present in the nose, care must be taken to previously remove them with a snare.

In doing the partial or complete operation, it is necessary that in addition to the nurse and anesthetist, two capable assistants should be present. Hemorrhage, which is always profuse, will keep the two assistants quite busy at times.

The question of preliminary tracheotomy is one to be settled by the surgeon. On account of the additional shock from the operation and the possibility of doing the operation without the preliminary

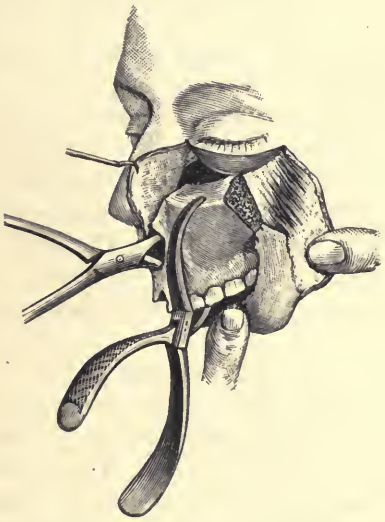

FIG. 132.—REMOVAL OF THE UPPER JAW.—Later stage. (After *Heath, Jacobson and Steward.*)

The flaps are reflected and held aside. The bones have been divided. The upper jaw is being disarticulated with the lion-jaw forceps while a pair of cutting-bone forceps complete the division of the palatine attachments.

tracheotomy, the majority of surgeons prefer to do the operation without this preliminary step. It must be borne in mind that tracheotomy may be necessary during this operation and consequently the surgeon should be prepared for this step whenever indicated. The position of the patient should be with the head slightly lowered

and the body slightly elevated so that gravity will aid in preventing the entrance of blood into the larynx.

The first incision suggested by Sir W. Ferguson or by Huguier should extend from a line slightly below the inner canthus parallel with the nose, round the alæ to near the center of the lip (Fig. 117), completely severing the lip. An incision is now made through the skin and the vestibule of the nose, connecting with the incision in the lip.

If the growth is large and the alveolar process is involved, a third incision is made from the corner of the mouth backward and upward sufficient to expose the angle of the jaw. With all bleeding points secured, a fourth incision is made along the gingivo-labial border down to the periosteum. The flap of the fascia is dissected back from the maxillary process until the entire bone is exposed. The incisor tooth is next extracted. With a narrow saw in the cavity, the floor of the nose, alveolar process and hard palate are completely sawed through. The saw is again directed to severing the jaw from its attachment with the malar bone. The sawing is continued, if a complete removal is desired, up to and through the bone forming the floor of the orbit and last through the nasal process of the maxillary bone.

If a partial resection only is indicated, the line of the saw will be below the floor of the orbit, through the superior portion of the antrum of Highmore. The section of bone is easily removed by a rocking motion with a strong forceps. If any portion of the malignant growth remains, it must be removed with a sharp curette.

Bleeding can usually be controlled by applications of tampons wrung out of hot water. If there be much bleeding, the wound may be packed with strips of gauze, which should be removed after tw nty-four hours. The flap is carefully sewed into position, care being taken that the mucous membrane of the mouth and soft palate is brought into apposition as far as possible. The head is bandaged and the patient put in a recumbent position. Strychnia, 1/30 grain, may be administered hypodermatically, if indicated, hot applications applied to the extremities, and in fact every effort should be made to avoid shock. Hypodermic injection of morphia should be given

the patient soon after the operation to insure rest. Water and liquid food may be given through the mouth with the aid of a soft tube.

Subsequent dressing consists in the removal of the packing, spraying with iced Dobell's solution, which, after fifty-eight hours, may be displaced by warm Dobell's solution for irrigation. It is unnecessary to repack the wound after forty-eight hours, depending upon the frequent spraying to keep the wound in a healthy condition.

CHAPTER XXVI.

DISEASES OF THE NASO-PHARYNX.

Acute Naso-pharyngitis.—Acute naso-pharyngitis is an acute catarrhal inflammation of the mucous lining of the vault of the pharynx and is often secondary to a like inflammation of the nose or oro-pharynx.

Etiology.—The causes are both predisposing and exciting. The predisposing causes are adenoids, enlarged tonsils, exposure to irritating gases and all the predisposing causes of acute rhinitis.

The exciting cause is the same as for acute rhinitis or acute pharyngitis. The disease may be produced from traumatism, from digital examination and injudicious use of the post-nasal spray.

Pathology.—The pathology does not vary from that of acute pharyngitis.

Symptomatology.—The general febrile symptoms are the same as observed in acute rhinitis. The symptoms may, however, be intensified in children. During the first twenty-four hours there is a dry, smarting and burning sensation in the vault of the pharynx with a sensation of swelling of the mucosa. The condition may extend to the mucous membrane lining the Eustachian tube, producing an active salpingitis.

The inflammatory condition of the naso-pharynx seldom confines itself to that region alone, but extends upward into the nose or downward into the lower portion of the pharynx. In the early stage of the disease, there is little or no secretion, followed by a reaction and a rapid accumulation of yellowish mucus which fills the naso-pharynx and drains downward over the pharyngeal wall. The patients try to dislodge the accumulation by hawking and expectorating. In those with an over-sensitive pharynx, gagging and even vomiting may be produced. The secretion may be tinged with blood.

Diagnosis.—Upon examination, rhinoscopically, the mucous membrane is red and slightly swollen. There is more or less accumulation of mucus varying in quantity according to the stage of the disease. The secretion may be stringy and somewhat adherent in the early stage of the disease.

Treatment.—The general treatment is directed to securing free purgation with calomel, followed by some aperient water. The diet should be regulated and alcoholic liquors and tobacco temporarily dispensed with.

The nose and naso-pharynx should be frequently irrigated with a warm Dobell's or Seiler's solution. Chlorid of zinc, 15 grains to the ounce of water, should be applied with a curved cotton-tipped probe once daily to the vault of the pharynx.

Two or three treatments are usually quite sufficient to cure the disease.

The local treatment should be followed by an oil spray consisting of aristol, acetoform, camphor and menthol (see formulæ, page 132), or acetozone inhalent.

The gastro-intestinal tract should be freed of all accumulation by the administration of calomel followed by a mild aperient water.

In very young children, steam inhalation of water and eucalyptus oil may be used every two or three hours, followed by an oil spray of acetozone.

Chronic Naso-pharyngitis. — Chronic naso-pharyngitis is a chronic catarrhal inflammation of the entire membrane of the naso-pharynx.

Etiology.—The exciting causes are more often due to recurrent attacks of acute inflammation of the naso-pharynx, chronic nasal catarrh, hypertrophies of the pharyngeal and faucial tonsils.

The predisposing causes are catarrhal, syphilitic, gouty or tubercular diathesis, chronic suppuration in the ethmoidal or sphenoidal cells, gastro-intestinal disorders, excessive use of alcoholic liquors and tobacco. The disease is very common among children and adults, in which there is present a lymphatic dyscrasia. The muciparous glands of the pharyngeal vault are well developed both from the inherited influence and inflammation.

Pathology.—In addition to the inflammation within the structure, there exists an hypertrophy and sometimes an hyperplasia of the mucous membrane and glandular structure, from which is poured out a muco-purulent exudation, filled with desquamated epithelium and debris.

Symptomatology.—The patient complains of a thick muco-purulent discharge from the vault of the pharynx, which is difficult to remove. Vomiting and retching may be produced by the efforts of the patient to remove the secretion by hawking. Indigestion is frequently one of the accompanying complications of the disease, produced by the infective material passing into the stomach. The disease predisposes to laryngitis, hoarseness and catarrhal inflammation of the lower air passages.

Diagnosis.—Upon inspection with a rhinoscopic mirror, the naso-pharynx is observed to be covered with a thick, stringy mucus, which, upon being detached with a post-nasal spray, discloses a variety of conditions. In one variety of cases there is a diffused hyperemia of the vault of the pharynx, in another, an irregular and profuse follicular condition. Where there remain well-developed adenoids or remnants of adenoids, a distinct glandular mass protrudes anteriorly. Another condition is a dry, glistening and reddened naso-pharynx, covered with stringy mucus. The patient complains of excessive dropping in the throat, sometimes headache and indigestion. The secretion accumulates in large quantities during the night and is discharged by prolonged hawking and coughing.

The disease may be confounded with Thornwaldt's disease (see Thornwaldt's Disease), syphilitic ulcer and chronic purulent discharge from the sphenoidal and posterior ethmoidal cells. However, the above diseases may be differentiated from chronic naso-pharyngitis by carefully cleansing the nose and naso-pharynx and inspecting with a rhinoscopic mirror.

Treatment.—The treatment is both local and constitutional. The local treatment is directed to securing free and uninterrupted nasal breathing by the removal of hypertrophies of the middle and inferior turbinates, spurs, glandular hypertrophies in the vault of the pharynx and faucial tonsils. It should be remembered that small tonsils

are frequently as great a source of irritation as large tonsils. They should always be explored for hidden pockets which contain debris and bacteria and in consequence, eliminate a toxin particularly irritating to the mucous membrane of the naso-pharynx. The secretion which is deposited upon the mucous membrane of the naso-pharynx can be dislodged by irrigation with a post-nasal douche or Pynchon post-nasal tip attached to a Davidson spray. Following cleansing, one of the following astringents may be applied with a curved cotton-tipped probe:

Argyrol in fifty per cent. solution, nitrate of silver, two to five per cent. and chlorid of zinc, two to five per cent. solution.

The following may sometimes be advantageously substituted for the above and applied with a curved applicator:

℞	Iodini,	.60 gm. (gr. x)
	Potassi iodidi,	20.00 gm. (gr. xxx)
	Glycerini,	30.00 c.c. (℥ i)

An astringent application may be followed by the following oil spray to the nose, naso-pharynx and oro-pharynx:

℞	Thymol,	.12 gm. (gr. ii)
	Menthol,	.30 gm. (gr. v)
	Camphor,	.20 gm. (gr. iv)
	Acetoform,	.12 gm. (gr. ii)
	Albolene,	30.00 c.c. (℥ i)

The patient should be instructed to use a mild antiseptic and astringent spray in the nose and naso-pharynx twice daily before meals.

The general treatment is directed to the correction of any dyscrasia, gastro-intestinal or pelvic disorders.

Change of climate, from a dry to a moist, high to a low altitude and vice versa, is sometimes extremely beneficial.

Naso-pharyngitis Hypertrophica Lateralis.—Naso-pharyngitis hypertrophica lateralis is a chronic hypertrophic inflammation of the lymphoid structure of the naso-pharyngeal mucous membrane situated along the lateral walls of the pharynx. The author has

taken the liberty of inserting the descriptive adjective, naso, to the classical name, pharyngitis hypertrophica lateralis, believing it to be etiologically the correct interpretation.

Etiology.—The disease is due to the causes producing a chronic naso-pharyngitis. It may or may not be associated with lymphoid infection in other parts of the pharynx.

Pathology.—According to Cordes, the bands are composed of a fibrinous reticulum, surrounding a collection of lymphoid follicles and are due primarily to a peculiar lymphoid diathesis which exists in many individuals, and secondarily to infection or prolonged irritation.

Symptomatology.—The patient complains of more or less catarrhal inflammation of the naso-pharynx. There is usually a history of hoarseness upon prolonged use of the voice. Women accustomed to singing and reading aloud are frequently compelled to give this up on account of the irritation. A reflex cough frequently takes its origin from the pharyngeal irritation produced by fibrous bands.

Treatment.—The general treatment is the same as for chronic post-nasal catarrh. The local treatment is a guarded application of the galvano-cautery every week or ten days until the bands are absorbed. The soft palate should be elevated for a more thorough application of the cautery. Care must necessarily be exercised in using the cautery on account of the danger of producing acute inflammation of the middle ear. The patient should be instructed to douche the nose and throat with a warm alkaline and antiseptic fluid twice daily. The excessive use of alcoholic liquors and tobacco is contraindicated.

Chronic Naso-pharyngeal Bursites (Thornwaldt's Disease).—Chronic naso-pharyngeal bursites was described in 1868 by Luschka and was further elucidated in 1885 by Thornwaldt, from whom the disease received its name. It is a pocket situated in the median line of the vault of the naso-pharynx, secreting a thick tenacious muco-purulent substance.

Etiology and Pathology.—The disease is primarily one of congenital origin and is, according to Schwabach, "the remnant of the middle cleft, the purse or blind pouch being the posterior end formed

by the partial agglutination of the margin and that it is but an integral portion of the pharyngeal tonsil taking part in the disease to which the latter is subject, but not possessing a pathological character of its own."

Symptomatology.—The symptoms vary in indivduals. In one

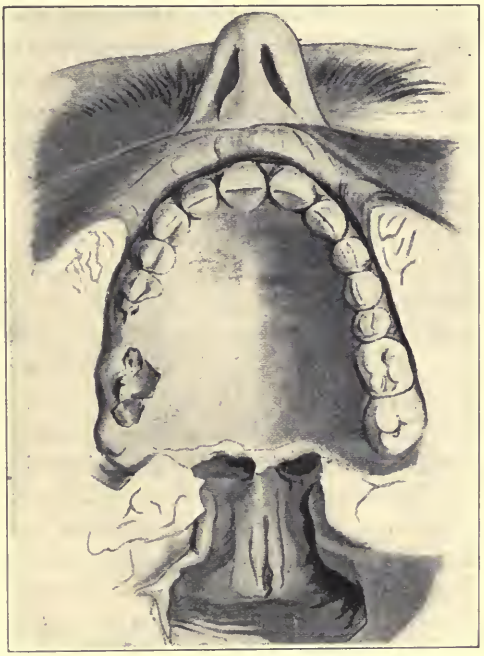

FIG. 133.—CONGENITAL CLEFT OF THE PHARYNX OR THORNWALDT'S DISEASE. (After *Dunbar Roy.*)

of the cases observed by the author, there was an entire absence of adenoids. However, in this case, the patient had passed the age in which we might expect absorption of adenoid tissue to take place.

The patient under observation complains of an active discharge from the naso-pharynx, varying somewhat in quantity from time to

time and influenced by the seasons. A thick, globular mass of mucus may be discharged from the naso-pharynx two or three times daily. The patient complains of a ringing in the ears and deafness, which is probably a condition of spongification of the labyrinth. There is no discharge from the nose and the patient's general health is good, other than as described above. Upon inspection, the oro-pharynx is seen to be covered with a glistening, mucus-like substance, adherent to the mucosa. Upon examination with a rhinoscopic mirror, a thick mass, muco-purulent-like, sometimes darkened from dust breathed into the nose, is observed upon the posterior wall in the median line, well into the wall of the pharynx. The accumulation is dislodged with a post-nasal spray and upon examination, a depression will be observed at the site of the meatus of the bursa and is sometimes slightly tinged with blood. Upon exploration with a probe shaped somewhat after a goose-neck, a distinct pouch is discernible, extending backward toward the vertebræ.

With the symptoms in mind, there is no difficulty in differentiating the disease from chronic naso-pharyngitis, chronic sphenoiditis or chronic posterior ethmoiditis.

Treatment.—Dunbar Roy, in an article on chronic naso-pharyngeal tonsillitis, read before the American Laryngological, Rhinological and Otological Society, 1901, says:

"The best treatment which I found in addition to the thorough cleansing which the patient accomplished at home, was an application of a solution of nitrate of silver, 60 grs. to the ounce, directly to the sulcus, followed by thorough spraying of the naso-pharynx with hot, melted vaselin and orthoform. The curette and electro-cautery point were tried. Thornwaldt recommends the destruction of the bursa by means of these latter methods. My own success was not at all gratifying. Schmiegelow, of Copenhagen, has reported three cases of obstinate post-nasal catarrh cured by cauterizing the bursa. Such success, however, has not been obtained by many other observers, and in fact, a majority report a rather small proportion of cures."

"The prognosis as to ultimate cure in these distinctly characteristic cases is certainly not brilliant, and the laryngologist will be taxed to his utmost to place the patient in even a comfortable condition."

In the author's two cases, all the above plans of treatment were instituted from time to time, and in addition, deep incision was made from the floor of the bursa into the pharynx, followed by curettement and cauterization with negative results. The chances for a complete cure as in the treatment of congenital fistulæ of the thyro-glossus duct, a somewhat analogous condition, depends upon the complete eradication of the bursal lining by curettement.

Hypertrophy of the Pharyngeal Tonsil or Adenoid Growths.—Histologically, adenoid growths are a hypertrophy of the normal lymphoid structures, situated in the vault of the pharynx, and are sometimes designated Luschka's tonsils or adenoid vegetation.

Etiology.—Lymphoid tissue within the vault of the pharynx is primarily a small histological structure undergoing absorption about the time of puberty.

Among the predisposing causes of hypertrophy of the lymphoid tissue are infection soon after birth, recurrent attacks of acute coryza, eruptive fevers, heredity, lymphatic diathesis, unhygienic surroundings and inherited dyscrasia.

Pathology.—The pharyngeal tonsil is covered with a columnar, ciliated epithelium which dips into the convolutions of the lobulated mass, which is composed of numerous trabeculæ of lymphatic tissue, surrounded by a delicate reticulum of connective tissue. It is very vascular, bleeding at the touch. From infection at birth or soon after, normal lymphoid follicles assume greater or less proportions, becoming abnormal structures.

There is usually associated with the disease, greater or less hypertrophy of the faucial tonsils and hypertrophy of the discrete lymph follicles of the pharynx. The disease is more frequently encountered in children, occurring a short time after birth. Holt and Jarecky mention their presence at birth, which leads to the conclusion that the condition of hypertrophy may be congenital.

In adults, the disease differs in structure from that seen in children. They are more fibrinous in structure and instead of being soft to the touch and irregular in outline, they are quite smooth and hard.

Symptomatology.—The most striking symptoms are the open mouth of the child while at rest and the alteration in the voice. The facial

expression varies according to the size of the growth and duration of the disease. Sometimes the face becomes distorted from the prolonged mouth breathing. The chin protrudes abnormally, the muscles at the angle of the nose become drawn and the alæ of the nose depressed.

The child may appear quite stupid from the dullness of hearing

FIG. 134.—ADENOIDS IN THE RHINO-PHARYNX. (After *Gruenwald.*)

and imperfect oxygenation of the blood. In typical cases, the voice has a peculiar dead quality, as described by Meyer.

The secretion in the nose and naso-pharynx is profuse in some cases and quite the reverse in others.

In many infants and young children with adenoids, there is imperfect development of the body and progressive inanition.

Deafness, which is frequently the cause of the physician being consulted, is due to the hyperplastic tissue extending down to and obstructing the ostium tuba, thus interfering with the rarefaction of the air in the tympanic cavity.

Hans Wilhelm Meyer, in 1868, first called the attention of the medical world to the influence of adenoids in the causation of deafness.

A passive hyperemia and consequent congestion of the mucous membrane of the Eustachian tube, with fibrous exudation and narrowing of the tube, follows interference with rarefaction of the Eustachian tube and middle ear. With an alteration in the atmospheric pressure in the middle ear, the membrana tympani becomes thickened and slightly retracted. If disease of the middle ear is continued for any length of time, the ossicles become agglutinated and deafness results.

Suppuration in the middle ear is a frequent sequela of adenoids. Many cases of acute and chronic otitis media get well with no other treatment than the removal of the adenoids and subsequent irrigation of the naso-pharnyx with a mild antiseptic and astringent wash.

In hypertrophy of the pharyngeal tonsils, sufficient to obstruct nasal respiration, there is always a decrease in the hemoglobin and red corpuscles.

Persistent nasal discharge, cough, spasmodic croup, night terrors, enuresis nocturna, snoring, parching of the mouth and pharynx and neuralgia are among the many symptoms accompanying the disease. Asthma is reported by Fränkel, Chatellier and Bosworth as many times dependent upon adenoid growths. The author recalls a case of asthma in a child in which there was immediate relief following adenectomy. Under the continued use of small doses of iodid of potassium, this case subsequently became quite well.

Diagnosis.—The facial expression of the patient, alteration in speech and catarrhal condition of the nose and throat suggest the disease. With a mouth gag or napkin rolled into a hard knot separating the jaws, the index finger can be easily passed behind the soft palate into the naso-pharynx in all but very young children. A soft mass may be felt, resembling, as described by Meyer in his original

article, a bunch of earthworms, and upon extraction of the finger, it will be slightly tinged with blood.

Massei recommended a cotton-tipped probe passed into the naso-pharynx and upon removal the cotton is stained with blood. A slight hemorrhage to the oro-pharynx may occur. In children old enough, with the rhinoscopic mirror, the vegetations may be detected. In exceptional cases, the vegetation may be seen upon simple inspection extending below the base line of the uvula. In the adult, when rhinoscopy is difficult, the soft palate retractor may be used after spraying the post-nasal space with a five per cent. solution of cocain.

Bosworth recommends for the detection of adenoids, spraying the nasal cavity with an oil solution. If the nose and naso-pharynx are clear, this will emerge from the opposite side as free as upon entrance. If there is an obstruction, the stream will be feeble or will not emerge at all.

Prognosis.—As far as life is concerned, the prognosis is favorable, if proper treatment is instigated. If pronounced, deformities of the face may never pass away. Care and attention to their correction by bandages, and instruction and drilling in proper nasal breathing, will often be very beneficial.

As a rule, deafness, one of the most frequent complications, is relieved by adenectomy and mild treatment directed to the middle ear.

Catarrhal deafness in after life is a frequent sequela of post-nasal adenoids in youth.

Treatment.—Operative interference is the only rational method in the treatment of adenoids. The removal of adenoids under narcosis is worthy of more than passing consideration.

The disease being found particularly in those of a lymphatic tendency, it is necessary that attention be directed to the method of operative procedure securing to the patient the least danger and the greatest amount of good. In the majority of cases, it is better to sacrifice a certain amount of thoroughness, which some operators claim cannnot be had without narcosis, for safety.

Among the anesthetics frequently used are chloroform, ether, ethyl bromid, nitrous-oxid gas, chloroform and ether combined, chloroform and nitrous-oxid gas combined and the A. C. E. mixture.

Meyer removed adenoids without the use of an anesthetic. Since Meyer's recommendation, many forms of narcosis have come into vogue. At the present time, the pendulum is swinging toward the side of operative procedure without a general anesthesia.

Among those who recommend the removal of adenoids without narcosis are B. Fränkel, Hartman, Gradle, Cline, Grayson and Killian. Knight is strongly in favor of nitrous-oxid gas followed by ether; Kaufeman, Cholewa and Shurly favor a general anesthetic; Bishop favors ethyl-bromid.

FIG. 135.—GOTTSTEIN'S ADENOID CURETTE.

In adults and older children with hypertrophy of the tonsils, a twenty per cent. solution of cocain will bring about almost total anesthesia. The hemorrhage following the operation will be no greater than without local anesthesia.

In operating under anesthesias, some surgeons prefer to have the child in the Rose position, with the head hanging over the edge of the operating table. Other operators prefer to have the child in an upright position in the lap of the nurse, guarded for any intubation. In this position, with the attendant holding the head firmly in position, the operation can be completed without general anesthesia.

Ethyl-bromid has been more frequently used by the author and with satisfactory results, though the danger of the anesthesia is quite as great as from chloroform or ether. The anesthetic effect of ethly-bromid is very short and only of sufficient length to enable a dextrous operator to remove adenoids and enlarged tonsils at the same time.

In the administration of an anesthetic, it is unnecessary to carry it to a point of complete narcosis. The presence of a cough and retch reflex will aid in expelling blood and particles of the detached growth.

Personally, I prefer a local anesthetic in children and adults, consisting of a ten to twenty per cent. cocain in adrenalin chlorid, 1/1,000, applied to the post-nasal space with a cotton-tipped probe. The pain of adenectomy in youth is very slight. The local anesthe-

sia probably fails to affect the whole lymphatic structure. However, it lessens the spasm of the pharyngeal muscles and pain caused by the introduction of the curette or biting forceps. The parent should

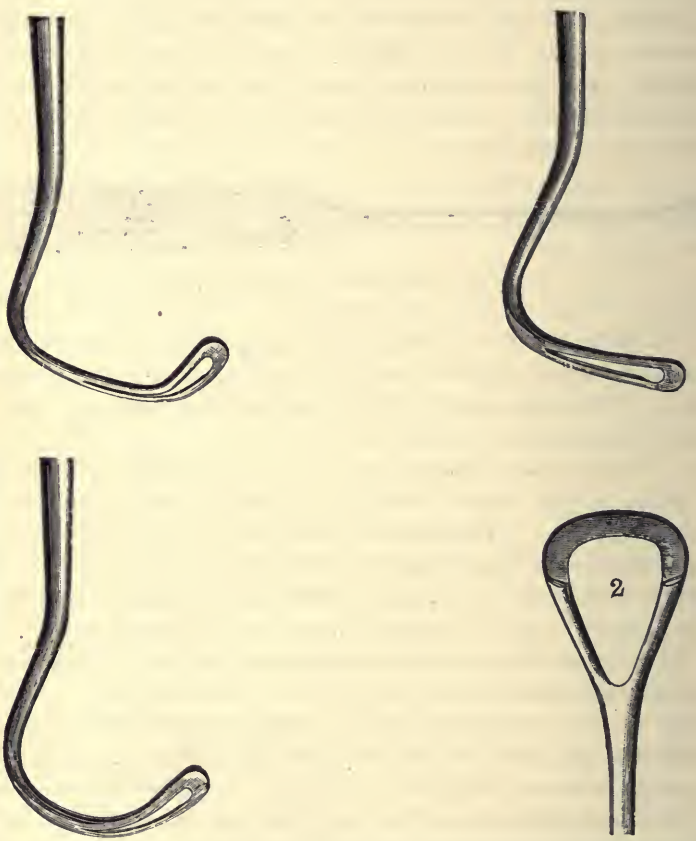

FIG. 136.—GOTTSTEIN'S ADENOID CURETTES, SHOWING SIZE AND SHAPE OF BLADES.

be warned of the possibility of the child crying and take necessary force in retaining it in position. The confidence of the child, if lost, can be as readily regained at its next visit, as argued by Knight.

There is a possibility of some of the growth remaining after the operation and also of a return of the lymphoid hypertrophy, as reported by Delavan and Wright.

The best surgical results are to be had with the Gottstein curette. This instrument still remains, with its different sizes (Fig. 135), the most satisfactory curette on the market. The smaller size can be used in very small children. The instrument necessary for the operation should be boiled for a period of ten minutes in a one-half per cent. solution of bicarbonate of soda. With the mouth gag in position, the curette is taken in the right hand and under good illumination, either natural or artificial, with the left index finger in the

FIG. 137.—BRANDEGEE'S ADENOID FORCEPS.

mouth acting as a guide for the curette and as a tongue depressor, the curetting angle of the forceps pointing slightly downward and outward is passed into the pharynx; the instrument is elevated and rotated on its axis and passed completely up into the post-nasal space. With the finger still in the mouth to aid in holding the curette in the median line to prevent injury to the ostium tuba and also to assist in drawing the curette downward if necessary, the adenoids are scraped away. The technique of passing the biting forceps into the naso-pharynx is the same as for the curette.

It is sometimes advisable to use the biting forceps first, followed by the curette. If the curette can be moved upward without meeting an obstruction, the probabilities are that the entire growth has been removed. As soon as the operation has been completed, the mouth gag should be removed and the head inclined forward to allow the blood to freely escape from the nose and mouth. It often happens that discrete lymph follicles remain on the lateral wall of the pharynx

about the Rosenmüller fossa. These can be removed under cocain anesthesia of the nose and naso-pharynx with a Meyer's curette.

Considerable hemorrhage through the nose or into the naso-pharynx may follow the operation. Adrenalin chlorid applied to the naso-pharynx will, in the majority of cases, completely stop the hemorrhage in a very few minutes. A number of deaths from hem-

Fig. 138.—Doyen-Kyle Post-nasal Biting Forceps.

orrhage following adenectomy are reported. Enlarged tonsils, which may be present, should be removed following the adenectomy.

The after-treatment consists in keeping the patient quiet for a few hours with rest in bed. The patient should not be exposed to irritating dusts for fear of infection, for a few days following the operation. The nose and pharynx should be frequently sprayed with diluted Dobell's solution (1/3) or Seiler's antiseptic tablet, one tablet dissolved in four table-spoonfulls of boiled water, continued for a week. Recovery is usually uninterrupted.

Under cocain anesthesia and adrenalin, the fiber-like tonsils in the adult can usually be removed at one sitting. Exceptionally, a second operation may be required to completely remove all the growth.

In cases suffering from inanition, a general tonic should be given. The following may be prescribed for children:

℞ Syr. ferri iodid, 30.00 c.c. (ʒ i)
Signa. Take ten drops in water after each meal.

For adults:

℞[1] Ferri pyrophosphatis, .15 gm. (gr. ii ss)
Strychnia, .00065 gm. (gr. 1/100)
Acidum phosphaticum dil., .32 c.c. (gtt. v)
(Form glacial only),
Exil. aromaticum, } āā q. s. ad., 4.00 c.c. (ʒ i)
Aquæ destil., }
Signa. Tablespoonful to be taken in water after meals.

Deafness or purulent inflammation of the middle ear should be treated according to the rules for that disease.

[1] Manufactured by Eli Lilly & Co., under the trade name of Pyroferrin.

CHAPTER XXVII.

DISEASES OF THE ORO-PHARYNX.

Acute Pharyngitis.—Acute pharyngitis is an acute inflammation of the mucous membrane of the pharynx and may be primary or secondary to an acute inflammation of the nose and naso-pharynx.

Etiology and Pathology.—The causes of the disease are both predisposing and exciting. The predisposing causes are chronic catarrh, excess of uric acid, gastro-intestinal catarrh, indulgences in alcoholic liquors and exposure to unhygienic surroundings.

The exciting cause is usually some septic infection which may gain entrance from the inspired air, food or diseased teeth. Any condition which may disturb the metabolism of the pharyngeal mucous membrane will predispose to infection from some pathogenic organism.

Symptomatology and Treatment.—In children, the disease may be ushered in with headache and a general malaise lasting for a few hours, followed by a high fever. In cases of fever without symptoms pointing to a specific disease in small children, a careful examination of the throat should be made. The fever and general systemic disturbance in the child as well as the adult, are often seemingly out of proportion to the local lesion. Pressnitz's bandage may be advantageously used during the stage of invasion.

Pastilles containing red-gum, potassium chlorid and cocain are especially recommended for home treatment. Should the case be seen at its conception, an old remedy which has been very efficient in aborting the attack should be given, and is as follows:

℞	Acetanilidi,	.60 gm. (gr. x)
	Tr. aconiti,	.24 c.c. (gtt. ix)
M.	For an adult.	
Signa.	To be taken at bed time.	

The patient should be given Dobell's solution for a gargle to be diluted one-half and be used every two hours. The patient must be instructed to close the nose during the act of gargling. The constitutional treatment consists in the administration of a saline cathartic. For the slight elevation of temperature, acetanilid in from one to five grain doses should be administered every three hours. The throat should be gently sprayed with iced Dobell's solution, followed by the application of nitrate of silver in five per cent. solution or chlorid of zinc, three per cent. solution, to be repeated every twenty-four hours. Spraying the throat with adrenalin chlorid quickly relieves the hyperemia. Any lesion of the nose or gastro-intestinal tract which may be a predisposing cause of successive attacks must, in the interim, be removed.

Chronic Pharyngitis.—Chronic pharyngitis is a chronic inflammation of the mucous membrane, sub-mucosa and glandular structures of the pharynx.

Etiology.—Among the many predisposing causes of the disease are successive attacks of acute pharyngitis, nasal obstruction, indigestion, chronic tonsillitis, rheumatism, excessive use of the voice, alcoholism, excessive use of tobacco, chronic bronchitis, tuberculosis of the lungs, and syphilis.

There is observed in the beginning of the disease a dry, glistening, swollen mucous membrane, and the patient complains of stiffening of the neck, with tenderness upon external pressure over the submaxillary region. The uvula may be hyperemic. The inflammation may extend to the mucosa of the Eustachian tube, producing partial and temporory deafness. The patient complains of dryness in the throat and post-nasal space, and the constant desire to swallow.

Hoarseness, due to extension of the inflammation of the larynx, may be present, though this is the exception.

Following the dry, glistening condition which lasts from five to seven days, we have a relaxation accompanied by more or less thick, tenacious exudation of mucus, which sometimes adheres to the surface, though easily detached with a spray. This condition may continue for three or four days, when recovery takes place.

Pathology.—The pathology of the disease varies somewhat accord-

ing to the chronicity of the inflammation. There is a hyperemia and swelling and sometimes hyperplasia of the mucous membrane of the pharynx extending down to and involving the sub-mucosa. The mucous glands in the early stages of the disease secrete an abnormal amount of mucus and later on become disturbed in their function, and in consequence, some of the glands undergo atrophy and the remaining secrete a thick, tenacious mucus. Later on, the mucous membrane may become atrophic and appear smooth and thin as though tightly stretched across the muscles of the pharynx.

Symptomatology.—The patient complains of an accumulation of thick, adherent, tenacious secretion which is found in the throat, particularly upon awakening, the dislodgment of which is very difficult and sometimes produces vomiting. The voice is somewhat husky and chronic laryngitis is frequently associated with the disease. The tongue is usually heavily coated and the appetite poor. Chronic constipation is frequently present. Upon examination, the pharynx, uvula and pillars of the fauces are found to be quite hyperemic and the pharynx is covered with a thick, tenacious secretion. The faucial tonsils are often hypertrophied and subject to recurrent attacks of inflammation. Small varicosities may be seen covering the surface of the mucosa, which may rupture and produce a slight hemorrhage. The disease is frequently observed in those who use alcohol and tobacco to excess, more particularly alcohol. A slight impairment of hearing, due to extension of infection through the Eustachian tube, is usually associated with the disease. The inflammation may be confined to the mucous membrane of the pharynx without involvement of the adjoining structures.

Diagnosis.—From the foregoing enumeration of symptoms, the diagnosis of chronic pharyngitis is comparatively easy. The influence of chronic hypertrophic pharyngitis upon the digestion and upon the general metabolism should not be overlooked and likewise the influence of the chronic gastro-intestinal disorders upon the production of the throat symptoms.

Prognosis.—The prognosis is somewhat variable and depends to a great extent upon our ability to overcome the general constitutional dyscrasias and the correction of the local cause producing the disease.

Treatment.—The treatment is both general and local. The general treatment is necessarily directed to the correction of any habits which are directly or indirectly irritating to the mucous membrane of the fauces and upper air passages, gastro-intestinal disorders, syphilis, rheumatism or tuberculosis. The general treatment should be particularly directed to the relief of constipation and disorders of the liver and in consequence, some mild aperient water would be given night and morning with an occasional dose of calomel and soda.

The local treatment consists in cleansing the nose and throat with a mild alkaline and antiseptic spray twice daily. The additional local treatment consists in the application by the physician, with a cotton-tipped probe, of a solution of twenty to thirty grains of nitrate of silver or a twenty to thirty grain solution of chlorid of zinc, followed by a spray consisting of the following:

℞	Iodini,	.06 gm. (gr. i)
	Camphor, Menthol, āā	.48 gm. (gr. viii)
	Ol. gaultheriæ,	.60 c.c. (gtt. x)
	Alboleni, q. s. ad.	30.00 c.c. (℥ i)

Small varicosities on the surface of the pharynx should be destroyed with the galvano-cautery, under cocain anesthesia.

Where the chronic inflammation is of a purely lithemic origin, the treatment consists in the avoidance of all red meats and alcoholic liquors, free ingestion of distilled water and plenty of out-door exercise. The patient should be given sodium salicylate in three to five grain doses every two or three hours or until the physiological effect of the drug is noticed. Effervescing phosphate and benzoate of soda in heaping teaspoonful doses may be given upon arising and at bed time. For the pain and aching in the throat, orthoform lozenges may be dissolved in the mouth every three or four hours. Hot, moist applications to the neck for one-half hour followed by massage are usually very beneficial.

Acute Follicular Pharyngitis.—As the name implies, acute follicular pharyngitis is an acute inflammation of the mucous membrane,

and more particularly, of one or more discrete lymph follicles of the pharynx.

Etiology.—The cause is often trauma of the pharynx, exposure to cold, gastro-intestinal disorders, influenza and subsequent infection.

Pathology.—There is a swelling of the lymph follicles of the pharynx and a hyperemia and swelling of the mucosa surrounding the follicles. The hyperemia is seldom diffused as in simple acute pharyngitis.

The infection may travel to the pharynx from the nose or be absorbed from the pharyngeal mucosa. The disease is essentially an inflammation of the follicles and not of the mucous membrane. Involvement of the mucous membrane is a secondary process.

Symptomatology.—The symptoms are the same as for acute pharyngitis with the exception that the patient is conscious of a localized irritation rather than a sensation of a diffused inflammation.

Diagnosis.—The red and swollen follicles are easily detected upon inspection, and may be quite small and distinct or welt-like and occupy a median or lateral portion on the pharynx. One or two small, acutely inflamed follicles may produce severe subjective symptoms out of all proportion to the objective signs of the disease.

Treatment.—The local treatment consists in the frequent use of a hot saline and antiseptic gargle with the nose tightly closed. Hot applications externally, antiphlogistin poultice or Pressnitz bandage to the neck are efficacious. A sixty grain solution of nitrate of silver should be applied to each follicle and repeated daily. One drop doses of aconite may be prescribed for controlling the fever, to be taken every hour until the symptoms of the physiological effect of the drug are observed.

Calomel is usually indicated at night, followed by some aperient water upon arising.

The severely painful swallowing may be partially alleviated by menthol, cocain and red-gum pastilles or orthoform lozenges dissolved in the mouth every two or three hours.

Chronic Follicular Pharyngitis or Clergyman's Sore Throat.—Chronic follicular pharyngitis is a chronic inflammation of the mucous membrane of the pharynx, characterized by an increase in the size of the lymph follicles.

Etiology.—The disease frequently develops from an acute follicular pharyngitis, predisposition to the disease, faulty personal hygiene, lymphatic diathesis, especially in the young, chronic naso-pharyngeal catarrh, excessive use of the voice, indigestion, pelvic disorders in women, tuberculosis of the lungs, use of tobacco, alcoholic liquors and rheumatic diathesis.

Pathology.—There is a hypertrophy of the mucosa and hyperplasia of the follicles and mucous glands. According to Shurly, the secretion is more abundant than normal and contains a large additional proportion of mucin, epithelial debris, lymphoid cells and mineral salts.

Symptomatology and Diagnosis.—There is a sense of ever present irritation of the throat. The amount of secretion varies according to the pathological change and may be profuse, thin, viscid or scanty. Huskiness of the voice and coughing follow the prolonged use of the voice in the adult. The quality of the voice is notably impaired. The general appearance of the pharynx varies and is that of a venous engorgement, of a pale pink, resembling the normal. The follicles appear red and project above the surface, sometimes surrounded by varicosities.

The tonsils may be enlarged and cryptic, containing infected cheese-like debris.

Treatment.—The treatment is directed to the correction of any gastro-intestinal disorders, injurious habits, rest of the voice, general tonics and training in the correct use of the voice.

The local treatment consists in the removal of any nasal obstructions and cryptic tonsils. The destruction of large follicles and varicosities is best done with the galvano-cautery. Care should be taken in the use of the cautery to avoid too great destruction of tissue at one time on account of the tendency to produce cicatrices which become a permanent source of irritation. Previous to the use of the cautery, the pharynx should be sprayed with a five per cent. solution of cocain, which renders the application of the cautery painless.

Applications of the cautery should be made at an interval of a week. In the absence of the cautery, nitrate of silver in a strength of sixty to one hundred and twenty grains to the ounce, should be

made to each follicle, care being taken not to injure the surrounding mucosa with the silver solution.

The following local application may be made by the patient once daily, by means of a cotton-tipped probe:

℞	Iodini,	.60 gm. (gr. x)
	Potassii iodidi,	1.20 gm. (gr. xx)
	Menthol,	.12 gm. (gr. ii)
	Glycerini,	30.00 c.c. (℥ i)

Atrophic Pharyngitis or Pharyngitis Sicca.—*Etiology.*—Atrophy of the glandular structures of the mucous membrane of the pharynx may be congenital or acquired and may be an extension from a like condition of the nose or may occur from a previous hypertrophic or follicular inflammation. All of the pharynx is usually involved.

Among the predisposing causes are habits and occupation of the patient, syphilis and inherited dyscrasia.

From the similarity of the disease to atrophic rhinitis, the etiology may, advisedly speaking, be considered the same as for that disease.

Pathology.—There is an atrophy of the entire mucous membrane and glandular structures and diminution in the size of the blood vessels and capillaries. In consequence of the atrophy of the follicles and mucous glands and a lessened amount of blood supply, there is a diminution in the secretion and the surface appears dry and glistening.

Symptomatology.—The patient complains of a dryness and stiffness of the throat and frequent hawking and efforts to dislodge a mucus-like substance which adheres to the pharynx. The symptoms are somewhat variable, changing according to the stage of the disease and the exciting cause. The general appearance of the entire pharynx is usually dry and glistening and covered with a tightly adherent, stringy secretion, extending over the entire pharyngeal wall. The wall of the pharynx may appear paler than the normal or a motley red. Atrophy of the nasal mucosa is also frequently present.

Treatment.—The internal administration of those remedies which stimulate glandular secretions is indicated (see Treatment of Atrophic Rhinitis), as iodid of potassium in limited doses and phosphorus in 1/100 grain doses. The throat should be sprayed with Dobell's solu-

tion. Following this, tincture of sanguinaria in glycerin is highly recommended. The following may be used as a spray three or four times daily:

℞ Phenol.,		.65 gm. (gr. x)
Tinct. iodi,		
Tinct. aloe,	āā	.60 c.c. (gtt. x)
Tinct. opii,		
Glycerini, q. s. ad.		30.00 c.c. (℥ j)

The following used in a nebulizer is very soothing and stimulating:

℞ Ol. cassiæ,	.36 c.c. (gtt. vi)
Ol. eucalypti,	.72 c.c. (gtt. xij)
Ol. gaultheriæ,	.72 c.c. (gtt. xij)
Menthol,	.60 gm. (gr. x)
Albolene,	30.00 c.c. (℥ j)

Any abnormal condition found to exist in the throat and nose must be corrected. The object of all such cases of atrophic degeneration is rather to secure relief. The possibility of a cure is in inverse ratio to the time of existence of the disease.

Acute Infectious Phlegmonous Pharyngitis.—This is an acute infectious phlegmonous inflammation of the pharynx, usually originating in one side of the pharynx and extending to deeper structures, terminating in death.

Etiology.—The disease is usually due to some form of traumatism, followed by virulent infection with some pus-producing organism.

Pathology.—There is a rapid swelling of the pharynx and infiltration of the sub-mucous structures, followed by a speedy formation of pus, which infiltrates the surrounding tissue, producing a general septic infection and ending fatally in from five to ten days. The organism producing the disease is presumed to be the staphylococcus, the streptococcus or a combination of the two.

Symptomatology.—The symptoms characterizing this disease are sudden soreness of the throat followed by swelling, difficult deglutition, pain in the throat, rapid rise of temperature (103° to 104°), headache, with symptoms of general infection, coldness of the skin,

clammy perspiration and dry tongue, often followed by early collapse and death.

The streptococcus pyogenes aureus is more often found in the greenish, fetid pus discharged from the diffuse abscess. The urine contains albumin.

Diagnosis.—From the foregoing enumeration of symptoms, redness and edema of one side of the pharynx, gradually extending to the opposite side, rapid formation of pus and profound systemic disturbances, the diagnosis is comparatively easy.

Treatment.—The treatment consists in placing the patient in the best possible hygienic surroundings. The throat should be frequently sprayed with Dobell's solution. Suspected abscess should be incised and drained. With symptoms of septic infection, antistreptococcus serum should be injected. A gargle consisting of the following, used every two hours will give great relief:

℞	Sol. antiseptici (Lister),	1.80 c.c. (gtt. xxx)
	Phenol,	.18 c.c. (gtt. iij)
	Glycerini,	1.20 c.c. (gtt. xx)
	Aq. menthol,	30.00 c.c. (℥ j)

Marked relief may also be experienced by the use of the Pressnitz bandage. Spraying the throat frequently with the following, acts as a local sedative and antiseptic:

℞	Phenol,	.30 c.c. (gtt. v)
	Menthol,	.30 gm. (gr. v)
	Ol. eucalypti,	.12 c.c. (gtt. ij)
	Albolene,	30.00 c.c. (℥ j)

After relief of the acute symptoms, the administration of some ferruginous tonic is indicated. Local treatment can be of little avail though we may try to relieve all the prominent symptoms. If asphyxia is imminent, tracheotomy may be resorted to, although nothing must be expected from it except temporary relief (Max Thorner).

The general treatment consists in the hourly injection of antistreptococcus serum and high enemas three or four times daily of a warm, normal salt solution. Additional treatment is generally supportive.

Erysipelatous Pharyngitis.—Erysipelatous pharyngitis is an acute inflammation of the pharyngeal mucosa and is often due to an extension of the erysipelatous inflammation from cutaneous structures of the nose or mouth.

Etiology.—The disease is due to an extension of a like inflammation from cutaneous structures of the face or may originate in loco and is due to infection with the streptococcus of Fehleisen, gaining entrance through a solution of continuity of tissue.

Pathology.—The disease involves the epithelium and upper layers of the submucosa. The epithelial cells become swollen and capillaries enlarged and filled with cocci. Vesicles form on the surface and near the center of the diseased area and are filled with a serous or sero-purulent fluid. The disease is considered contagious under favorable circumstances.

Symptomatology.—In the beginning of the disease, there is usually a marked swelling of the submaxillar and cervical glands. The patient complains of smarting, dryness and burning sensation in the throat and difficult swallowing. If the swelling becomes very great, speech is difficult and dyspnea may occur. The disease may occur epidemically, as described by many writers. Such an epidemic occurred in America in 1842, and was known as the "black tongue."

Upon examination, the pharynx is found to be swollen, of a deep reddish color which is circumscribed or diffused. In the diffused form of the disease, one or both tonsils and the pillars of the pharynx may be swollen, with sometimes an extension of the disease to the nose or Eustachian tube and middle ear.

"Vesicles soon form over the surface of the pharynx, which rupture and discharge a serous or sero-purulent substance, leaving behind yellowish or white patches, which are easily removed" (Warren).

The tongue is heavily coated and may become more or less swollen. In severe cases, the glottis may become swollen and the disease is described as extending to the lungs.

Diagnosis.—Sudden chill, followed by high temperature, coated tongue, enlargement of the cervical and submaxillary glands, followed by deep redness with zigzag outline, smarting and burning of the

pharynx independent or accompanying facial erysipelas, will suggest the disease.

Phlegmonous erysipelas resembles phlegmonous pharyngitis so closely that the two cannot be differentiated.

Course and Prognosis.—The disease usually runs its course in from five to six days and more often terminates in recovery. In involvement of the middle ear, rupture of the drum may or may not follow.

Treatment.—The treatment consists in the internal administration of iron in large doses, preferably the chlorid. Internally, extract of suprarenal gland in five grain doses is recommended. Local spraying of the throat with adrenalin chlorid, 1/10,000, or one-half of one per cent. solution of cocain reduces the hyperemia and lessens the pain. Hot Dobell's solution should be used as a spray or gargle every hour during the day and frequently at night. Free purgation is essential in the very beginning of the disease. The patient should be isolated.

Scarlatina Angiosa.—Of all the exanthematous diseases, that of scarlet fever brings about the most varied and far-reaching destructive inflammatory changes in the pharynx, extending often to the middle ear and accessory sinuses. In consequence of the gravity of the angiose form, space is given to the treatment of throat affections resulting from the disease.

Diagnosis.—The diagnosis of scarlet fever is, as a rule, dependent upon the preliminary symptoms, *i. e.*, sudden vomiting, rise of temperature, rapid pulse, strawberry tongue, sore throat and the appearance upon the neck and chest at the end of the first or the beginning of the second day, of a scarlet rash, which spreads over the surface of the body.

Upon inspection of the throat, the pillars of the faucial tonsils and the entire pharynx are found to be intensely inflamed and covered with a catarrhal exudation. The nasal respiration may be occluded from the swollen mucosa and exudation, compelling the child to breathe through the mouth. The exhalation from the mouth is very offensive.

The lymph glands of the neck are greatly swollen from absorption

of toxins and in extreme cases may suppurate. Suppuration of the middle ear may occur on account of the severe infection which is presumed to be of a streptococcoic origin.

Treatment.—The local treatment consists in cleansing the nose and naso-pharynx, pharynx and mouth with a warm Dobell's solution, diluted with three parts of water. If the child is old enough, a gargle of one-half per cent. hot Dobell's solution may be used every hour. If the nasal mucosa is so swollen as to prevent spraying the nose, a preliminary spraying or dropping into the nose of a solution of adrenalin, 1/5,000, with an ordinary eye dropper, will so shrink the mucosa as to enable fluids to pass into the pharynx.

If we are unable to satisfactorily clear the pharynx with the Dobell's solution, resort should be made to a gargle or spray of equal parts of peroxid of hydrogen and witch hazel. Local applications may now be made to the pharynx twice daily, consisting of a two per cent. solution of chlorid of zinc or a two to four per cent. solution of nitrate of silver, followed by a local application with a cotton-tipped probe or a spray of the following every two hours:

℞	Menthol,	.12 gm. (gr. ii)
	Creasoti,	.18 gm. (gr. iii)
	Iodini,	.16 gm. (gr. i)
	Alboleni,	30.00 c.c. (℥ i)
M.		

As the inflamed condition passes away the local application of astringents may be less frequent. The Dobell's solution and oleaginous spray should be continued at least twice daily until the patient is quite well.

Gangrenous Pharyngitis.—*Etiology and Pathology.*—Gangrenous pharyngitis is a circumscribed necrosis of the mucous membrane and the subcutaneous tissue, and is due to trauma, scarlet fever, diphtheria or septic embolism. Gangrene of the cheek or noma, usually affecting children under the age of seven or eight years, may have its origin about Stenson's duct, perforating the cheek and extending back to the pharyngeal wall. The disease usually terminates in death. However, in rare cases the disease ends in recovery, with a perforation of the cheek and the formation of deep scars.

Symptomatology and Diagnosis.—There are marked constitutional symptoms with high fever and sometimes delirium. There is a rapid loss of flesh due to inanition from general systemic poisoning. The diagnosis of necrosis is comparatively easy. The disease should be differentiated from diphtheria or scarlet fever. However, in the malignant form of the two diseases, gangrene may ensue.

Treatment.—The treatment is directed to combating the general infection by supporting the strength with nutritious foods, stimulation by means of whisky and strychnia and controlling the pain by opiates.

The throat should be treated with a spray or gargle every hour with a one per cent. solution of carbolic acid, followed by peroxid of iron. Orthoform dusted on the surface will act as a germicide and local anesthesia.

For the mitigation of the odor of decomposition in noma, Gruenwald recommends dusting the parts with freshly roasted and ground coffee.

Hemorrhagic Pharyngitis.—Hemorrhagic pharyngitis is an acute or chronic condition of the pharynx, characterized by the formation of minute or confluent hemorrhagic spots.

Etiology.—The disease is especially observed in those with a hemorrhagic diathesis and may accompany a follicular pharyngitis. The general health of the individual is often found greatly impoverished from inherited or acquired disease.

Pathology.—Small hemorrhagic extravasations may arise in the course of general diseases and are due to a rupture or leakage through the vessel wall into the mucous membrane. In congenital cases, small, deep, reddish, follicular-like extravasations may be seen on the pharynx, surrounded by varicose veins. The condition usually accompanies a hemorrhagic diathesis.

Symptomatology and Diagnosis.—The patient is susceptible to recurrent attacks of pharyngitis and frequently, tonsillitis. There is usually present a naso-pharyngeal catarrh and varicosities of the septum. Hemorrhages from the pharynx, characterized by the spitting of blood, are infrequent.

The diagnosis, upon inspection and history of frequent nose bleed and symptoms of hemophilia, is unmistakable.

Treatment.—The treatment consists in the correction of any constitutional diathesis and the avoidance of tobacco and alcoholic liquors.

The local treatment consists in the destruction of the varicose vessels and the deep reddish, follicular-like infiltrations of the pharynx with the galvano-cautery.

Pharyngitis (Seu Angina) Ulcerosa.—Ulcers of the pharynx are localized areas of necrosis. Their size and location vary according to the site of the trauma or inflammation predisposing to the lesion.

Etiology.—Syphilis easily takes precedence as a caustive factor, followed by infection from pathogenic organisms, especially the staphylococcus aureus or the streptococcus pyogenes, tuberculosis and cancer following next in frequency.

Trauma of the pharynx or localized disturbances of metabolism may be brought about by hot or cold drinks, foreign bodies or constitutional dyscrasia. Ulcers in this region are comparatively infrequent.

Course and Prognosis.—Ulcer of the pharynx is usually slow in its growth and well developed before observed by the surgeon. The prognosis is good under favorable treatment, the recovery being complete.

Diagnosis.—Pain and irritation in the throat, odynphagia, hoarseness and general debility are some of the symptoms suggestive of this disease. There is frequently a history of some general infective disease, though such a history is not always forthcoming.

The patient complains of a loss of flesh, great pain in the throat, difficult swallowing, frequent regurgitation of fluids through the nose and partial or complete loss of voice.

Upon observation, a variety of changes may be noted in the pharynx. The site of the lesion may be noted in the center or sides of the pharynx extending from the naso-pharynx into the laryngo-pharynx. It may be round or oblong. The borders are well defined and the edges more or less congested. Necrotic tissue may fill the ulcer or a comparatively clear-cut floor may be present. The ulcer may extend over the vertebræ, partially or completely destroying the pharyngeal muscles.

The diagnosis of an ulcer is easy. It should be borne in mind that cancer may resemble a syphilitic or infective ulcer. The border in the former may be pale instead of being red and granular.

The hemoglobin test of Justus may be used in the differentiation of syphilis. With this test a hemoglobin estimation is made, followed by a strong mercurial inunction. After twenty-four hours a second hemoglobin estimation is made and if we find a ten to twenty per cent. reduction of hemoglobin, we are comparatively safe in pronouncing the disease syphilis.

In addition to this, there remains the old test of heroic doses of the iodid of potassium, which, if syphilis, will bring a quick response in the relief of all symptoms.

Cancer of the pharynx is differentiated by microscopical section, general cachexia and foul-smelling odor, which, as a rule, accompanies the disorder.

Regardless of the cause of the ulceration, there is present a mixed infection, due to the ever-present pathogenic organisms within the oro-pharynx.

Treatment.—The treatment resolves itself into both general and local, the general treatment necessarily depending upon the cause producing the disorder. If due to syphilis, a saturated solution of iodid of potassium in twenty drop doses should be given in abundance of water after meals, increasing the dose daily until the reaction is noted.

If due to any other cause, the iodid of potassium is seldom indicated and, broadly speaking, a general tonic such as iron, quinin and strychnia, is indicated. The exciting cause, whatever it may be, should, as far as possible, be eradicated.

If due to tuberculosis, in addition to the general tonic treatment and open air, curettement and application of formaldehyde, 1/20 ounce daily, is indicated. For cancerous ulcer, curettement, the X-ray and internal administration of Fowler's solution, four drops three times daily, should be given.

Infective ulcers are treated like ulcer in any other portion of the body. The treatment consists in general tonic treatment, free purgation, cleansing with peroxid of hydrogen in full strength, followed

by argentum nitrate, fifteen to thirty per cent. solution, or trichloracetic acid, fifty per cent. solution. The ulcer should be treated once daily until recovery is complete. In addition to a hot gargle of Dobell's solution, full strength, orthoform lozenges may be prescribed for home treatment. The orthoform will act as a sedative and antiseptic.

Diabetic Pharyngitis.—Diabetic pharyngitis is a chronic inflammation of the pharynx, due to interference with the nutrition of the mucous membrane from diabetes.

Symptomatology.—The symptoms, as described by Verdos, are dryness of the throat, difficult swallowing and tenacious accumulation of mucus.

Treatment.—The general treatment is that recommended for diabetes.

The local treatment consists in mentholized sprays and astringents, such as iodin, biborate of soda, etc. Freudenthal records one case of diabetic ulceration and recommends for treatment twelve and one-half per cent. orthoform emulsion.

Tuberculosis.—The disease may be primary or secondary to a pulmonary tuberculosis and is due to infection with the tubercle bacilli.

Pathology.—The disease may appear as a nodular or ulcerative form of lupus infiltrate. Infection may reach the pharynx from a tuberculous lung, through food or inspired air, gaining entrance through some localized solution of continuity. Submiliary tubercles form in the submucosa and may develop into nodular infiltrations, which are soft and bleed to the touch. They may undergo softening, degeneration and formation of an ulcer. The ulcers are somewhat yellow, with regular, granular edges, and are covered with thin mucous exudation.

Symptomatology.—There is usually a history of dryness of the throat, huskiness of the voice, sometimes slight bloody expectoration and a drawing sensation in the throat. On account of the absence of pain, the disease is usually far advanced before the physician is consulted.

Diagnosis.—In an ulceration of the throat, accompanied by a pulmonary tuberculosis, as a rule, the diagnosis is easy. In simple uncomplicated tuberculosis of the pharynx, the diagnosis is only

reached by a process of exclusion. The disease resembles syphilis and in consequence heroic doses of iodid of potassium and inunctions of mercury are indicated until proof positive of the absence of the disease is established. Following this, the injection of tuberculin may be tried. The tuberculin test may give no reaction in a mild case of tuberculosis of the pharynx. Where there is slow formation of granulomatous tissue, in the absence of a positive diagnosis of syphilis or cancer, the disease, advisedly speaking, is tuberculosis. The tubercle bacilli, which is sometimes found in the granulomatous mass, renders the diagnosis positive.

Prognosis.—Providing the disease is a purely local one and all the diseased tissue can be removed by curettement, the prognosis is favorable. Years after the removal of localized infiltration, many cases develop a pulmonary tuberculosis, due to a latent pulmonary tuberculosis antedating the pharyngeal infection or synchronous with, or due to, a secondary infection with the tubercle bacilli from a tubercular tendency.

Treatment.—The treatment is both general and local.

The general treatment consists in giving the patient the advantage of nutritious diet, plenty of out-door exercise free from dust and irritating gases, and free ventilation of sleeping apartments.

The local treatment consists in cleansing the nose and throat frequently with Dobell's solution, curettement of the follicles and ulcerative patches, followed by the application of nitrate of silver in solid stick. Sometimes the galvano-cautery may be applied every week or two. The throat may be sprayed once daily with a one-twentieth solution of a forty per cent. formaldehyde.

Lupus.—Lupus vulgaris is a chronic and low form of tuberculosis, sometimes involving the pharynx.

Etiology.—The causes are both predisposing and exciting. The predisposing causes are a tubercular diathesis, trauma and exposure to tubercular infection by association with tubercular patients.

The exciting cause of the disease is the tubercle bacilli.

Pathology.—The lesion is characterized by the formation, in the mucous membrane and subcutaneous tissue, of distinct velvety red or grayish-red nodules about the size of a sago grain and may be

general or localized. They undergo slow ulceration or absorption with the formation of distinct scars. The nodules are made up of a small, round-celled infiltration and typical tubercular giant cells, the nuclei of which point to the periphery. Between the cells is a

FIG. 139.—LUPUS OF THE PHARYNX. (After *Birkett.*)

network of fine connective tissue fibers. The tubercle bacilli are found only in small numbers and with great difficulty.

Symptomatology.—There is frequently a history of tuberculosis in the family. The general condition of the patient may be, as far as general appearance is concerned, quite normal. The patient, on account of the insidious nature of the disease, suffers but little irritation of the throat until ulceration is far advanced and contiguous structures are involved.

Diagnosis.—Upon inspection of the fauces in the early stages of the disease, apple-jelly-like nodular growths about the size of a sago grain, separate and distinct, are observed on one or both sides of the pharynx. With the caseous degeneration, the nodules appear gray and soon break down and leave a reddish base. The pharyngeal mucosa is hyperemic and sometimes covered with mucus. The disease may spread to the pillars of the fauces, tonsils, soft palate and larynx. The disease should be differentiated from syphilis or herpes of the pharynx.

The tuberculin test should give a positive reaction, that is, increase of local hyperemia and rise of temperature with a return to the normal in from twenty-four to thirty-six hours.

Microscopical examination of the curetted mass should show a typical arrangement of the giant cells, small, round-celled infiltration and sometimes tubercle bacilli.

Treatment.—The general treatment is directed to the correction of any constitutional dyscrasia and the avoidance of alcoholic liquors and tobacco.

The local treatment is frequently disappointing and consists in curettement followed by the application of nitrate of silver in solid thick.

H. S. Birkett reports flattering results in the cure of a case of lupus of the pharynx, shown in Fig. 139, by the application of the Roentgen ray. The tube was placed ten inches from the patient with ten minutes' exposure. The patient's face was protected with a wooden shield painted with eleven coats of white lead on both sides. Daily applications of the X-ray should be made unless untoward symptoms are observed, when a longer interval of time may be substituted.

Glanders.—Glanders is an acute or chronic purulent inflammation of the pharynx, due to infection from the bacillus Mallei.

Etiology.—The disease is more often observed in those habitually in contact with horses and from which infection is blown or carried by the hands of the individual to the face. The organism producing the disease is known as the bacillus Mallei, first discovered by Löffler and Schutz.

Pathology.—The disease is characterized by the formation of pem-

phigus-like vesicles at the point of infection, which soon suppurate, producing an ulcer and sometimes gangrene. Metastatic infiltration may occur on the face, trunk and extremities, which rupture, discharging a purulent secretion and in chronic cases an ill-smelling pus.

Symptomatology.—The symptoms of the disease are somewhat variable and may be mild or severe. In the mild form of the disease, we have the formation of vesicles which rupture with a discharge of pus. The ulcers heal after a short time without any general symptoms.

In the severe form of the disease, following the period of inflammation, there is observed a marked swelling and inflammation of the submaxillary and cervical lymphatics, rapid rise of temperature, general prostration, headache, pain upon swallowing, dryness of the throat and sometimes hemorrhage and formation of pustules over the body. The disease rapidly extends to the nose and face. Gastro-intestinal disorders may supervene and also acute, purulent, septic bronchitis.

The discharge from the throat and post-nasal space is thick, foul-smelling, yellowish pus, sometimes streaked with mucus and blood. The duration of the acute form of the disease, in favorable cases, is usually sixteen days.

In the chronic form of the disease, the course is variable and acute exacerbations frequently occur until the patient succumbs to the disease.

Diagnosis.—The history of occupation, sudden onset of the disease, the grave constitutional symptoms, formation of multiple abscesses over the pharynx, sometimes involving the nasal cavity, formation of pustules of the skin and discharge of a foul-smelling pus, are diagnostic signs of the disease. In addition to the above, discovery of the presence of the bacillus Mallei in the secretion or by inoculation into guinea-pigs, is sufficient to differentiate the disease. On blood serum, the growth is opaque and of a bright yellowish color.

Prognosis.—The prognosis of the disease is usually unfavorable. The majority of cases both in the acute and chronic forms terminate fatally; in the acute form in from one to two weeks, and in the chronic form in from a few months to a year.

Treatment.—The treatment consists in the curettement of the granulated tissue, spraying with peroxid of hydrogen, followed by the application of carbolic acid, two per cent., in albolene.

The general treatment is directed to flushing the metastatic abscess and combating the systemic infection. Should the case terminate favorably, tonic doses of iron, quinin and strychnia are indicated.

Syphilis.—Syphilis of the pharynx may be primary, secondary or tertiary.

Primary Syphilis.—Primary syphilis of the pharynx is very infrequent. The position of initial lesion may be on the tonsils, posterior pillars, pharyngeal wall or about the pharyngeal orifice or Eustachian tube. In the latter region, the infection is more often carried by a Eustachian catheter. Syphilis is presumed to be due to the spirochæta pallida, an animal micro-parasite, discovered by Schaudinn and Hoffman. It is a pale, corkscrew-like thread, from four to ten microns in width, and seven microns in length.

Secondary Syphilis.—The mucous patches are more often observed upon the soft palate, pillars of the fauces or the tonsils and less frequently on the pharynx.

In the congenital and acquired form of the disease, the secondary lesions may manifest themselves in mucous patches, ulcerations, hyperplasia of the mucous membrane, hemorrhagic extravasations and varicosities. According to Morrow, ulcerations are generally found in the median line of the vault and at the juncture of the palatal process and the superior maxilla. The areas of destruction on either side are equal and symmetrical.

Tertiary Syphilis.—In the tertiary stage of the disease, there may be gummatous formations, tumors, diffused infiltrations and ulcerations.

Congenital tertiary lesions vary but little from those of the acquired. They usually manifest themselves early in life, whereas the tertiary lesions of acquired syphilis are usually observed in those past the eighteenth year.

Symptomatology.—The symptoms of the primary sore or hard chancre are usually smarting or slight pain in the region of the chancre and swelling of the submaxillary or cervical glands. There is an

increase of mucus in the pharynx. The presence of mucous patches usually give rise to the symptoms of simple pharyngitis. There is an accumulation of mucus, huskiness of the voice upon exercise and exacerbation of any catarrhal condition of the nose or naso-pharynx.

The symptoms of tertiary syphilis vary somewhat according to the character and stage of the local condition.

The symptoms of tertiary specific pharyngitis, accompanied by marked swelling of the mucous membrane, are the same as those for chronic pharyngitis. In the gummatous stage, the patient may complain of pain in the throat and neck. The growth usually gives rise to some difficulty in swallowing and if situated within the region of the nasal pharynx, there is an impairment of the voice and nasal respiration and sometimes regurgitation of fluids through the nose. The size of the gummata is variable and may be very small or quite large.

In the ulcerative stage of the disease, which is usually due to the breaking down of the gummata, the patient complains of an irritation in the region of the ulceration, accumulation of muco-purulent substances, frequent expectoration, sometimes regurgitation of fluids through the nose, huskiness of the voice, painful and difficult swallowing and loss of flesh.

Diagnosis.—The primary lesion of the pharynx is often overlooked. The location of the hard chancre, in the author's experience, has been more often on the tonsil. The general appearance is that of a mild ulceration, covered with white, glistening mucus. There is usually marked enlargement of the cervical and lymphatic glands.

The skin manifestations of the disease in suspected cases render the diagnosis positive.

The mucous patches are observed to be irregular in outline with a distinct, whitish border, and are covered with grayish exudation. Mucous patches are often found on the soft palate, tonsils and posterior wall and may disappear in a few weeks or may form superficial ulcers. A mucous patch is so distinctive that there is little danger of error in the diagnosis. It is a good rule to remember in all ulcerative conditions of the throat the ever-present possibility of syphilis.

Tertiary lesions of syphilis may resemble simple ulceration, chronic

pharyngitis, chronic interstitial tonsillitis, lupus, tuberculosis, actinomycosis or cancer. Within the tongue may be one or more gummata, which appear above the surface and are hard to the touch. The scar tissue, which results from the healing of the deep ulcerations of the pharynx and soft palate, resembles the scars from malignant diphtheria, scarlet fever and lupus.

In doubtful cases of secondary and tertiary syphilis, the diagnosis is usually made clear by inunctions of mercury and iodid of potassium, internally.

The author has seen a few cases of tertiary syphilis in the throat in which there was a history of removal from the lip, a number of years previously, of a hard nodular growth, presumably cancer. The immediate results following the administration of iodid of potassium proved conclusively that the induration removed from the lip was not a cancer, as diagnosed by the surgeon, but a hard chancre.

Syphilis is not infrequently diagnosed as sarcoma or carcinoma.

Treatment.—The general treatment is so well understood and outlined in all text-books that repetition is unnecessary.

The local treatment consists in cleansing the pharynx, pillars and tonsils with a mild alkaline and antiseptic spray. If the hard chancre, mucous patch or ulceration is present, it should be gently touched once daily with a fifty per cent. solution of trichloracetic acid on a cotton-tipped probe. The patient should be instructed to use a hot antiseptic gargle three or four times daily and to avoid the use of tobacco and alcohol. The recovery from secondary or tertiary inflammation of the throat under the iodid of potassium and mercury is usually very rapid. The necessary dose of the iodid of potassium to bring about resolution, is variable and may range from a few grains, especially in young children, to from three to four hundred grains per day in adults.

Actinomycosis.—Actinomycosis is an inflammation of the pharynx and tonsil, characterized by the formation of an irregular and hard nodule, which subsequently suppurates and discharges pus.

Etiology and Pathology.—The disease is due to infection from the ray fungus which gains entrance to the nose or pharynx from spores

of grain, diseased teeth, inspired air, chewing of portions of plants, straw or wood containing the ray fungus. The disease frequently occurs in cattle, horses, dogs and swine and may be transmitted to man.

The disease may originate primarily in the larynx or nasal cavity.

The pus from discharging nodules contains a typical, yellow, granular mass, which, upon compression, forms a rosette-like structure, opaque or yellowish in color. With Mallory's stain, the center of the rosette stains blue and the club-shaped structure, red.

Symptomatology.—There is usually a history of slow swelling in the angle of the jaw, and difficult swallowing. Upon inspection, if suppuration of the mass has not already occurred, the tumor is seen to be distinct and fills the angle of the jaw and palato-glossal region, and is firm to the touch, resembling somewhat the clinical appearance of cancer. The tumor may soften and discharge pus containing yellow granules.

Treatment.—The treatment of this particular disease is unsatisfactory. Iodid of potassium in large doses is highly recommended by many. Puncturing with the galvano-cautery, opening and curetting the granulated tissue or cauterizing the wound with solid stick of nitrate of silver may be efficacious.

Sawyer reports flattering results from the injection into the tumor of from fifteen to thirty minims of one per cent. solution of potassium iodid at an interval of three to four days.

Heroic surgical measures for the removal of all affected tissue is often necessary.

Retro-pharyngeal Abscess.—Retro-pharyngeal abscess is a circumscribed or diffused formation of pus behind the velum palati, the deep mediastinal or cervical structures, and has its origin within the submucosa or lymphatic structures.

Etiology.—The disease is often observed in children and is due to an infection from the streptococcus pyogenes.

Symptomatology.—The disease is usually ushered in by a chill, followed by a high temperature and rapid pulse. There is pain and difficult swallowing, mouth breathing, headache, restlessness and sometimes delirium.

Diagnosis.—Upon inspection, there is observed a circumscribed swelling with marked redness and rapid bulging of the inflamed area. If the abscess is high up behind the palate, there may be profuse redness of the pharynx and soft palate. The presence of pus can be demonstrated by palpation or pressure with a probe.

Treatment.—The treatment is essentially surgical and consists in opening the abscess under a local anesthesia of from ten to twenty per cent. solution of cocain. Complete drainage must be established.

FIG. 140.—EVACUATION OF A RETRO-PHARYNGEAL ABSCESS. (After *Veau.*)

As soon as the pus begins to flow from the incision in children, the body should be elevated and the head extended downward, so as to prevent the pus from entering the larynx.

Subsequent treatment consists in cleansing the throat with peroxid of hydrogen and witch hazel, equal parts, followed by a spray of Dobell's solution.

Following convalescence, a general tonic treatment is indicated.

Pharyngomycosis.—Pharyngomycosis is a condition of small

whitish, horn-like excrescences, appearing sometimes upon the tonsils, pharynx, palate, anterior or posterior pillars, larynx or lingual tonsils.

Etiology.—The disease is a fungus growth or a keratosis springing from the follicle of the pharynx and crypts of the tonsils and is due to leptothrix buccalis or possibly some chemical change in the body, which produces a local irritation with the subsequent formation of horny-like excrescences. The disease is more often observed in women. The term Heryng's pharyngomycosis leptothrica and Jacobson's algosis, or phycosis leptothrica faucium, are synonymous for the same condition.

Diagnosis.—Upon inspection of the throat, small horny-like, white excrescences appear protruding from the surface. Upon being grasped with fixation forceps, they are observed to be tightly adherent, leaving a bleeding surface upon being detached. The general appearance of the mucous membrane of the throat may be quite normal or the same as that observed in chronic pharyngitis.

Treatment.—The treatment is purely local and consists in the application of the electro-cautery under a local anesthesia of ten per cent. solution of cocain. One application to each excrescence is usually sufficient to destroy the fungus growth.

The treatment should be repeated every few days until all evidences of the disease have passed away.

L. M. Hurd reports a case of pharyngomycosis cured after forty-one treatments of ten minutes each with the X-ray, a medium tube with a spark gap of about three inches being used.

Urticaria.—Urticaria of the pharynx is an inflammation of the mucous membrane, characterized by the formation of reddish elevations or whorls upon the surface of the pharynx. The condition is observed in the throat, mouth, larynx and intestinal mucous membrane.

Etiology.—The disease may occur at any age, more frequently, however, in early life. The disease may be due to some local irritation or to some general disorder, more particularly some disturbance of the gastro-intestinal tract. Many individuals have a susceptibility to the disease and a predisposition from the ingestion of certain meats and vegetables. The disease may be associated with diabetes

mellitus, albuminuria, smallpox, malarial and yellow fever, and pulmonary diseases.

Pathology.—The disease is probably due to some disturbance of the vaso-motor system from toxic infection. The distinct elevation of the mucous membrane is due to a collection of serum within the mucous membrane.

Symptomatology.—The patient complains of a smarting and burning sensation in the throat and difficult swallowing. The eruption is somewhat short-lived, new eruptions taking the place of the old ones until the disease runs its course, which is usually from one day to a week.

Diagnosis.—There may be a history of recurrent attacks of throat affection or eruption of the body from ingestion of certain foods, medicines and psychic impressions.

A whorl-like formation of the eruption, with smarting, itching and burning, enables one to readily diagnose the case.

Prognosis.—The prognosis is usually favorable. However, in severe cases, in connection with urticaria of the skin, the disease may sometimes terminate fatally.

Treatment.—The treatment is directed to the relief of the gastro-intestinal disorders by the administration of a free purge. Dorsey's mixture is probably one of the best which can be given. Effervescent salicylate of soda should be given in heaping teaspoonful doses in water, every three hours. The patient should be instructed to avoid all those conditions and substances, which, from experience, have been found to be an irritant to the mucous membrane.

Hot Dobell's solution and hot glycothymolin should be used as a gargle or spray every two or three hours.

Herpes.—Herpes of the pharynx is an acute inflammation of the mucous membrane, characterized by the formation of small, whitish, pin-head-like vesicles on the mucous surface.

The disease is presumed to be of a neuropathic origin and may be associated with gastro-intestinal disturbances. The disease may follow from exposure to cold or damp weather or traumatism.

According to Stelwagen, there is a growing belief that the disease is sometimes of infectious origin.

Symptomatology.—The disease is characterized by the formation of small, white points, which are clustered over the pharyngeal mucosa and continue from five to six days.

There is a slight elevation of temperature, difficult deglutition and profuse redness of the mucous membrane, with a catarrhal exudation.

Treatment.—The treatment is both local and constitutional. The constitutional treatment consists in the administration of quinin and strychnin with an effervescent salicylate or benzoate of soda.

The local treatment consists in spraying or gargling the throat frequently with the following solution:

℞	Potass. chloratis,	1.30 gm. (gr. xx)
	Phenol,	.12 c.c. (gtt. ij)
	Glycerini,	3.75 c.c. (℥ j)
	Aquæ destill., ad.,	30.00 c.c. (℥ j)

M.

Signa. Teaspoonful in a wine glass of water, to be repeated every two hours.

Local irritation can sometimes be greatly ameliorated with orthoform lozenges, one of which may be dissolved in the mouth every two or three hours.

Pemphigus.—Pemphigus of the pharynx is an acute or chronic inflammation of the mucous membrane, characterized by the formation of small, round or oval blebs, upon the pharyngeal wall.

Etiology.—So far, no specific organism has been designated as a cause of the disease. The disease may be due to trauma, gastro-intestinal disorders, irritation of the peripheral nerves and diseases of the nervous system. Acute pemphigus is presumed by many writers to be of a microbic origin.

Pathology.—According to Otto, there are two forms of pemphigus of the respiratory tract, viz., one forming bullæ with lifting up the epithelium, causing adherence, usually occurring in the debilitated and situated in the nose, soft palate, pharynx and conjunctiva; another attacking healthy individuals, situated primarily in the respiratory tract and consisting of a fibrinous exudate.

Symptomatology.—In the acute stage, we have fever, headache,

and general malaise with more or less difficulty in swallowing. One characteristic symptom of the disease is the formation of bullæ which may be observed over the wall of the pharynx, uvula, cheek or tonsil. Skin lesions may accompany the disease. The bullæ soon rupture and thus give rise to a whitish, yellowish or blackish patch (Johnston). With the formation of ulcers, the soft palate may adhere to the pharynx and likewise the posterior pillars of the fauces. The disease run its course in from two to three weeks, and is not presumed to be contagious. In the chronic form, the only conspicuous symptom is the recurrent whitish or yellowish ulceration over the pharynx or soft palate, without general systemic involvement.

Diagnosis.—Pemphigus may be confounded, in the beginning, with diphtheria, lupus or syphilis. In the acute stage of the disease, the course is rapid and does not respond to antisyphilitic treatment. It may be differentiated from diphtheria by culture and microscopical examination. The membrane covering the ulcers is often adherent and like that of diphtheria, causes bleeding upon detachment.

No general symptoms aid in the diagnosis in the chronic form. Recurrent patches of ulceration covering the soft palate or pharynx may be observed to extend over a period of years.

Prognosis.—Unless the ulceration extends to the stomach, the prognosis is favorable.

Treatment.—In the acute stage, the treatment is directed to thorough catharsis by the administration of small doses of calomel, followed by a saline cathartic. Hot gargles of Dobell's solution, diluted one-half, may be frequently used.

The headache, fever and general malaise pass away with the lessening of the infection from the frequent use of hot, antiseptic gargles.

Arsenic may be prescribed in the form of Fowler's solution, four drops in water three times daily.

The treatment of the chronic condition is in no wise different from that of the acute.

Membranous Pharyngitis.—Membranous pharyngitis is an acute inflammation of the pharynx, characterized by the formation of a croupous exudation.

Etiology.—The causes are both predisposing and exciting. The

predisposing causes are the same as for acute catarrhal inflammation of the upper air passages. The exciting cause is infection from the streptococcus pyogenes.

Pathology.—The disease is characterized by the formation of a fibrous exudation upon the surface of the pharynx, which has no tendency to adhere to the surface or to bring about any structural alterations in the epithelium. The disease is primarily one of streptococcoic origin. There is a hyperemia and swelling of the mucous membrane and epithelium and an increase of blood supply to the parts.

Symptomatology.—The disease is sudden in its onset and may be accompanied by headache, vomiting and rise of temperature.

The symptoms are somewhat variable and may be mild with little local or general disturbances or quite the reverse.

Treatment.—The treatment consists in frequently spraying the throat with Dobell's solution or the application of Löffler's solution once daily, followed by a spray of acetozone inhalent. In young children, a Simplex steam inhaler may be used to advantage. The small sponge may be moistened with one drachm of the following:

℞ Menthol, 1.90 gm. (gr. xv)
Oil eucalyptus, 30.00 c.c. (℥ i)
M.

Signa. To be used in inhaler for fifteen or twenty minutes four times daily.

The patient should remain quietly in bed until the inflammatory symptoms have passed away. Small doses of calomel are usually indicated early in the disease. The elevation of temperature can, as a rule, be controlled by cold sponge baths.

The patient's diet should be carefully regulated and consist only of those foods classified as a soft diet.

Diphtheria.—Diphtheria, in a generic sense, is an acute infectious and contagious exudative inflammation of the mucous membrane of the throat with constitutional symptoms due to the Klebs-Löffler bacillus.

Etiology.—The causes of diphtheria are both predisposing and exciting.

Among the predisposing causes of diphtheria are lowering of the vitality from exposure to cold, adenoids, enlarged tonsils or some form of dyscrasia.

Children under ten years of age are more prone to diphtheria than adults. However, the disease may occur at any age.

Seasons play but little part in predisposing to the disease, but the damp, cold days of fall and winter lower the resistance of the mucous membrane of the body and favor the disease. Sporadic cases may occur the year through. The opening of the public schools is often followed by the appearance of an epidemic of diphtheria among the children.

Children and adults may possess a natural immunity to the disease. Active immunity from the disease may last for a lifetime or only for a short period. In consequence, individuals may suffer a second attack. The disease may occur sporadically, epidemically or endemically. Unhygienic surroundings, heavy rains with floods, decaying animal and vegetable matter all aid in spreading the disease.

The exciting cause of the disease is the Klebs-Löffler bacillus, which (Fig. 46) attacks the mucous membrane. The organism is long-lived and may be carried from one individual to another, by cat, dog, cast-off clothing, drinking water, milk or by direct exposure. The average period of residence in the throat is twenty-nine days. Cases are recorded where organisms remained in the throat one hundred and twenty days.

The bacillus of diphtheria may be present in the throat before any local or general symptoms occur, and in consequence, it is easy for one child to spray the organism directly into the mouth and nose of an associate during conversation and play.

Pathology.—Infection with the diphtheria bacillus produces an exudation with a rapidly developing coagulation necrosis extending down into the mucous membrane. When the exudation is forcibly detached, a bleeding surface remains. The exudation may be diffused or discrete and may extend from the pharynx to the soft palate, tonsils and nose, or downward into the larynx and bronchi. The

severity of the disease depends, to a great extent, upon the amount of exudation. The sequelæ of the disease are often out of all proportion to the severity of the inflammation. At first, the exudation is white or gray, changing later to a yellow or grayish-green. In typical cases, the exudation gradually fades away during the process of recovery.

The Klebs-Löffler bacillus may be found on the surface or within the exudation. The organism frequently remains in the pharynx for twenty-nine days after all active inflammation has passed away.

The disease may spread to the lungs, esophagus, stomach, conjunctiva, Eustachian tube, nose and middle ear.

In severe cases, we frequently have a mixed infection from the staphylococcus or streptococcus and sometimes both.

The disease is primarily a local infection, followed by systemic disturbances due to the absorption into the system of the toxins of the bacillus of diphtheria.

True diphtheria differs from the false in that true diphtheria is only produced by the Klebs-Löffler bacillus, whereas, in the latter, the disease is producd by some other organism, more especially the pseudo-diphtheria bacillus, streptococcus, staphylococcus or a combination of the last two named. The two conditions can only be differentiated by microscopical examination. The clinical appearance of the two diseases is quite the same.

Symptomatology.—The general symptoms vary from those of mild infection to profuse septicemia.

The temperature varies from a few degrees above normal to 104° F.

The prodromal symptoms, which continue from two days to a week, but more often two or three days, are general malaise, headache, loss of appetite and restlessness, followed by nausea and sometimes vomiting, dryness of the throat, painful swallowing and a rise of temperature. The tongue becomes coated, the urine is highly colored and often shows traces of albumin.

If there is an extension to the naso-pharynx, there is mouth breathing and an accumulation of purulent catarrhal exudation within the nasal cavity which is sometimes offensive in character. Should the disease extend to the larynx, there is dry cough and hoarseness.

With increase of dyspnea, we have cyanosis and delirium. On the third or fourth day, the exudation may be coughed up in shreds, or, in severe cases, a cast of the larynx and trachea may be expelled in the act of coughing. This may or may not reform. If two thousand units of antitoxin are used at once, the possibility of the cast being reformed is greatly reduced. In the severe form of the disease, the pulse is rapid and feeble and the temperature may become subnormal. However, in severe cases with mixed infection, the temperature may be very high. A low temperature is more often observed. The disease may run its entire course without a rise of temperature.

Course.—The disease usually runs its course in from one week to ten days. It may end in four or five days in spontaneous recovery in mild cases. In severe cases, the disease reaches a crisis in about four to six days, the recovery being slow.

Since the introduction and the universal use of the antitoxin of diphtheria, the mortality has been reduced and the course of the disease much shortened.

With the subsidence of all inflammatory symptoms, mild or severe cases of palsies frequently occur. The one most frequently observed is paralysis of the soft palate, causing a regurgitation of liquids and food particles. Paralysis of the accommodation may occur and is shown by the inability of the patient to read or see objects distinctly, close at hand. Paralysis of the diaphragm and paraplegia of the lower extremities sometimes occur. Myocarditis and atrophy of one or more nerves of special sense, from inflammation or from infection, are frequently observed. Albumin is, as a rule, a transitory condition but frequently becomes a serious complication if the patient is too quickly exposed to atmospheric changes during the convalescence.

Prognosis.—The prognosis must, from necessity, be guarded. From general observation, the mortality with antitoxin is about twelve per cent., as against sixty per cent. before the days of antitoxin. As a rule, the patient recovers from the palsies in from six to ten weeks. Acute nephritis sometimes occurs.

The earlier the injection of the antitoxin, the more favorable the prognosis. Kidney complications are presumed by some to have increased since the use of antitoxin.

Diagnosis.—In the positive diagnosis of diphtheria, we should remember that the clinical symptoms of diphtheria and follicular pharyngitis are quite the same. Rubens reports one hundred and seventy-nine cases of suspected diphtheria, in which all the clinical symptoms pointed to the disease, but upon microscopical examination, only twenty-six were found to be suffering from diphtheria and one hundred and fifty-three were negative, *i. e.*, due to cocci and pseudo-diphtheria.

The presence of the Klebs-Löffler bacillus may be discovered by a swab of the throat in the hyperemic stage before the exudation occurs. If there is reason to suspect diphtheria, an early culture should be made.

It is a good rule to suspect some throat affection in children with a rise of temperature.

Under good illumination, the throat on the first day of the inflammation may show one or more thin, white or bluish-white spots occupying the crypts of the tonsils or coalescing over the whole surface of one or both tonsils. After twenty-four hours, the exudation will appear as a heavy yellowish or greenish-yellow velvet-like membrane with a distinct outline. The surrounding mucous membrane may be slightly or very greatly indurated. On or about the third day, suppuration begins with a muco-purulent discharge. The disease may spread in any direction; if into the nasal cavity, there is a thick muco-purulent discharge from the nose; if to the larynx, there is a dry cough, cyanosis and difficult breathing.

The odor from a diphtheric throat is very characteristic. A catarrhal exudation differs from a true diphtheria in being thin and glistening and detached from the surface. In diphtheria, the exudation adheres to the mucosa and causes the surface to bleed upon being detached.

The bacteriological examination consists in making a swab from the inflamed surface and applying it directly to the culture of blood serum. After six to twenty-four hours in an incubator, 37° C., a thin, whitish, granular layer forms. A smear on a cover-glass is now made, dried and stained with Löffler's alkaline methylene-blue solution. The bacillus does not take an even stain, and, as shown

in Fig. 46, the granules appear more deeply stained than others at the end of the bacillus or throughout its length. Differential stain of Neisser may be sometimes used for staining.

Treatment.—In all suspected cases, according to a great many investigators, it is better to give an injection of antitoxin at once and make the bacteriological examination afterward. The earlier the injection of antitoxin, the greater the possibility of a favorable termination. The antitoxin of diphtheria has no influence upon infection from any other organisms, and if the careful rules of antisepsis are carried out in making the injection, the serum is perfectly harmless.

Antitoxin is now an official U. S. P. preparation, with the official dosage from five thousand to fifteen thousand units. Experience has shown that there is no lethal dosage of antitoxin—as much as one hundred thousand units being frequently given. Antitoxin, to be effective, must be used in sufficient dosage to completely neutralize and destroy the toxin produced by the residence of the diphtheria bacillus in the throat. Every symptom of the disease, from the local coagulation necrosis to the remote paralytic sequelæ, are caused by this toxin, and the failure to neutralize any portion of this toxin produces symptoms and sequelæ in proportion to its amount unneutralized.

Children require practically the same dosage as adults. Five thousand units should be the minimum initial dose in any case, and probably eight thousand. If a sufficient dosage is given, the membrane will loosen in four or five hours, and the persistence of the membrane without amelioration of symptoms for six hours after the injection of antitoxin, is evidence that it has been used in too small dosage, and more antitoxin should be given.

A prophylactic dose is fifteen hundred units.

Sudden heart failure is a not uncommon event, and the patient should be kept very quiet for at least one week after cessation of all symptoms. Irregularity of heart action is due to destruction already wrought by the toxin of diphtheria, and antitoxin will not affect destruction that has already taken place, it will, however, prevent further destruction.

To follow the antitoxin dose, internally at the onset of the disease,

calomel in one-tenth grain doses should be given every hour until the bowels are freely moved.

The local treatment consists in the application of Löffler's solution, under good illumination, to the whole of the affected area two or three times daily.

℞	Menthol,	10 parts
	Toluol,	26 parts
	Ferri perchloridi sol. fort.,	4 parts
	Alcohol,	100 parts
Signa.		

The action of Löffler's solution is to lessen the fibrous exudation and act as a mild antiseptic and anesthetic.

Trypsin dusted directly over the air exudate is highly recommended on account of the property it possesses of digesting the exudation.

The following may be frequently used as a cleansing spray to the throat:

℞	Boralyptol, Hamamelis dest., Hydrogen peroxid,	āā	30.00 c.c. (℥ i)
℞	Sodii biboratis,		.12 gm. (gr. ii)
	Menthol,		.06 gm. (gr. i)
	Phenol,		.24 gm. (gr. iv)
	Glycerini,		4.00 c.c. (℥ i)
	Aq. destill., ad.		30.00 c.c. (℥ i)

The internal medication is directed to counteracting the poisonous effect of the toxemia. Weakness in the heart's action may be controlled by the administration of digitalin, two to fifteen drops in combination with tincture of strophanthus, five drops, three times daily. Apollinaris water diluted with distilled water should be freely administered for flushing the kidneys. In the stage of convalescence, a general tonic may be indicated. One of the best tonics is a solution of iron, strychnia and hydrochloric acid.

Palsies, which frequently occur, should be treated by the internal administration of strychnin and small doses of potassium, and the direct application of the constant current, the negative pole to the affected parts.

In suspected cases of diphtheria, to prevent the spread of the disease, the child should be isolated. Children susceptible to the disease should be injected with six to eight hundred units, the prophylactic dose of antitoxin.

Handkerchiefs, napkins and cotton used for the reception of secretion from the nose and throat should be incinerated. Napkins, towels and bed linen may be immersed in an antiseptic solution before

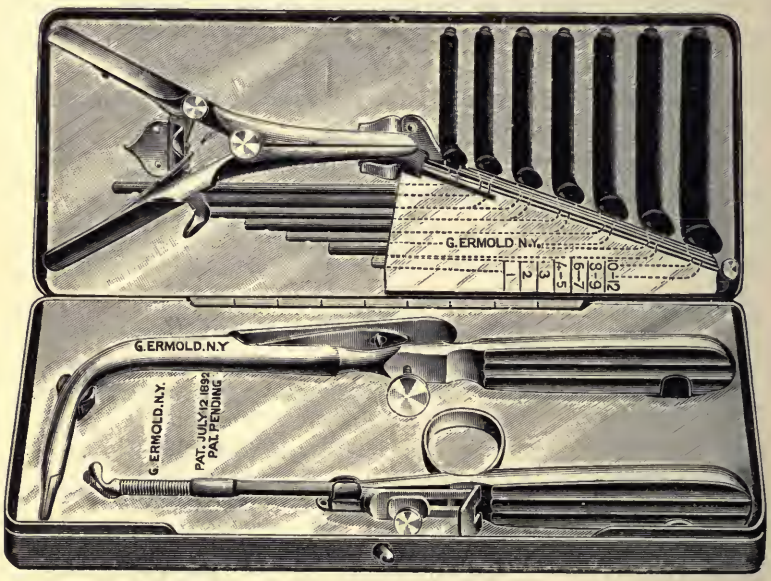

Fig. 141.—O'Dwyer's Intubation Set.

removal from the patient's room and the bed linen and all other clothing should be fumigated with formaldehyde during and after convalescence.

Intubation of the Larynx in Diphtheria.—Since the introduction of the antitoxin treatment of diphtheria suggested by Behring, intubation is not so frequently practiced. Dyspnea from diphtheria and causes heretofore enumerated now occasionally demand this procedure.

Instruments and tubes designed by O'Dwyer meet the greatest number of indications. The set, in a metal case, consists of an introducing and extracting instrument, seven tubes varying in size, a metal finger-stall and a strong mouth gag.

The patient should be held upright, the arms confined by a sheet over the body, the mouth gag is inserted and the head steadied by an assistant. The forefinger of the left hand is passed far back into the glottis until the tip of the epiglottis can be felt. The tube is then inserted in the median line, the handle of the introducer depressed to the chest of the child. Upon the tube reaching the finger, which acts as a guide, the handle is elevated and drawn forward, the finger now guiding the tube into the larynx. Previous to inserting the tube, a strong silk thread should be passed through the shoulder of the tube. This is looped over the little finger of the left hand to prevent the tube slipping into the esophagus. The thread can be looped over the ear of the patient for a few hours or withdrawn immediately after the tube is known to be in position. In removing the thread, the index finger is introduced and held against the shoulder to prevent the tube from dropping out of position.

The removal of the tube is often far more difficult than its insertion. For this, the extracting instrument is used. The index finger of the left hand is again passed to the tip of the epiglottis and acts as a guide for the extractor. As soon as the closed blades enter the tube they are separated and firmly held in position while the tube is carefully withdrawn.

Neuroses of the Pharynx.—Among the more common neuroses of the pharynx are anesthesia, hyperesthesia, paresthesia, neuralgia, spasms and neurosis of motion.

Anesthesia.—Anesthesia is a partial or complete loss of sensation of the pharynx and may result from progressive bulbar paralysis, constitutional dyscrasia and general paralysis of the insane. It may be a frequent accompaniment of hysteria.

The treatment is subjective and depends upon the exciting cause. Galvanic current is usually indicated with increasing doses of strychnin internally.

Hyperesthesia is an over-sensitiveness of the pharyngeal mucosa

and is usually due to hysteria, excessive use of alcoholic liquors and tobacco, elongation of the uvula, heredity and acute or chronic inflammation of the pharynx.

The treatment consists in the administration of large doses of potassium bromid, followed by the cessation of alcoholic indulgences and the use of tobacco.

The local treatment is directed to the relief of the catarrhal condition which is usually present.

Paresthesia is an hysterical manifestation and is a sensation of some foreign body in the throat. The patient may complain of burning, smarting and itching in the pharynx. There may be a follicular inflammation of the pharynx and enlargement of the follicles at the base of the tongue.

The treatment is directed to building up the general nervous system by the administration of iron, quinin and phosphate of zinc.

Spasm of the pharyngeal muscles may be due to cerebral disorders, hysteria and epilepsy. The disease may be of a purely psychical origin and observed in hysterical individuals.

The treatment is usually the same as for hyperesthesia and paresthesia. If due to enlarged tonsils, operative measures are indicated.

Neuralgia of the pharynx is observed more frequently in hysterical individuals. It may accompany a uric acid, anemic or chlorotic diathesis. It may be due to the presence of malignant growths in contiguous structures.

The treatment is directed to the removal of the cause. Hot antiseptic gargles will sometimes give relief.

Neurosis of Motion may be due to diphtheria, tumors of the medulla, progressive bulbar paralysis, syphilis of the pharynx, injury to the facial nerve, etc.

In paralysis following injury of the facial nerve, diphtheria or syphilis, the prognosis is usually favorable.

The prognosis in tumor of the brain and progressive bulbar paralysis is unfavorable. In addition to the general alterative treatment, strychnin internally with galvanic electricity is indicated.

CHAPTER XXVIII.

DISEASES OF THE UVULA.

Deformities of the Uvula.—Deformities of the uvula may be congenital or acquired, two distinct uvulæ may be present or bifurcated, as shown in the illustration (Fig. 142). Congenital cleft of the uvula may occur. Cleft palate is a congenital condition familiar to every reader. The entire soft palate and uvula may be destroyed

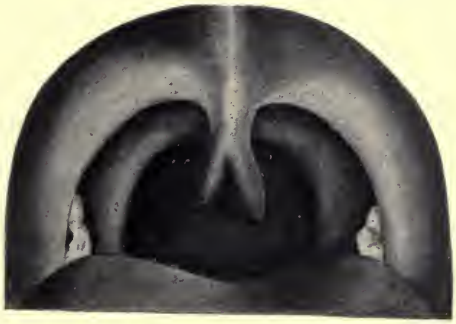

FIG. 142.—BIFID UVULA. (*Knight.*)

from disease, especially syphilis, lupus, tuberculosis and diphtheria. The treatment of all deformities is necessarily surgical and varies according to the symptoms.

Acute Uvulitis.—Acute uvulitis is an acute inflammation of the mucous membrane and loose areolar tissue of the uvula.

Etiology.—The causes are both local and general. The local cause is more often traumatism from hot drinks, foreign bodies or inflammation of the contiguous structures.

The general causes may be atmospheric changes during sleep, indigestion, alcoholic excesses, nephritis, anemia or lithemia and angio-nucleated edema.

Pathology.—Edema of the uvula is a serous exudation into the areolar tissue and may be a vaso-motor disturbance due to some toxic disturbance and independent of any local bacterial influence.

Acute inflammation is characterized by swelling, redness and discomfort. In inflammation of the pharynx and tonsils, there may be an extension of the disease to the uvula by continuity of tissue.

Symptomatology.—There is a sensation of fullness in the throat, difficult swallowing, disturbance in the voice and accumulation of mucus with the frequent desire to swallow. If the edema is profound, dyspnea may occur. Upon examination, the uvula is observed to be swollen and translucent or red and edematous.

Treatment.—If edema is very great, the uvula should be anesthetized with a ten per cent. solution of cocain and punctured in a number of places with a sharp bistoury, followed by a hot astringent gargle.

Acute inflammation and edema may frequently be relieved by an application of a solution of nitrate of silver, one hundred and twenty grains to the ounce. The throat should be frequently gargled with a hot astringent solution.

A saline cathartic is usually indicated in the treatment of the disease.

Ulceration of the Uvula.—Ulceration of the uvula is a circumscribed solution of continuity of tissue.

Etiology.—The cause is usually some form of traumatism followed by infection. Among the general diseases predisposing to ulceration of the uvula are syphilis and pulmonary tuberculosis. Syphilis, lupus and tuberculosis may be primarily situated in the uvula.

Symptomatology.—There is a smarting and burning sensation in the throat, sometimes followed by pain upon swallowing cold or hot drinks. Those who smoke may complain of increased irritation following the use of tobacco.

Diagnosis.—The site of the ulceration is variable and it may be located anteriorly or posteriorly. If situated posteriorly, the ulcer is only seen with a rhinoscopic mirror or by elevating the uvula.

Treatment.—The uvula and throat should be cleansed with a warm alkaline and antiseptic solution, followed by the application with a cotton-tipped probe once daily, of a fifty per cent. solution of trichloracetic acid or the solid stick of nitrate of silver.

The general treatment is directed to the relief of any general dyscrasia. Lupus may be relieved with an application of the X-ray. Tubercular ulceration should be curetted and cauterized with a solid stick of nitrate of silver. Swollen and infected cervical submaxillary lymph glands demand removal.

Elongated Uvula.—*Etiology.*—Elongated uvula may be an acute or chronic condition, and is usually due to an acute or chronic pharyngitis.

Symptomatology.—The symptoms of elongated uvula are general catarrhal inflammation of the throat, hawking cough and tickling in the throat. The cough is more distressing at night while in bed.

Treatment.—If the elongation is very small and quite recent, the application of a solution of nitrate of silver, one hundred and twenty

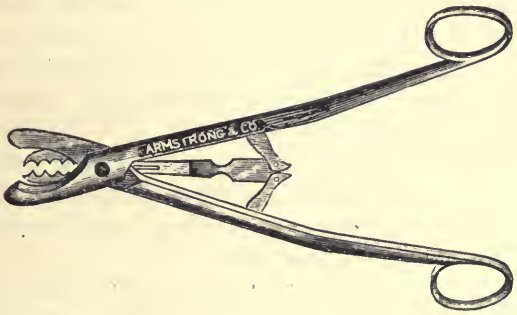

FIG. 143.—SAJON'S UVULA SCISSORS.

grains to the ounce, applied to the uvula once daily, may reduce the deformity.

The treatment is usually surgical and consists in the removal of the elongation with uvula scissors (Fig. 143), or the removal of the V section and stitching the lateral halves together. A ten to twenty per cent. solution of cocain and 1/1,000 solution of adrenalin, will render the operation both painless and bloodless. Where the elongation is removed with scissors, the stump should be painted with a strong solution of nitrate of silver.

Subsequent treatment consists in cold antiseptic gargles for twenty-four hours, followed by hot antiseptic gargles.

CHAPTER XXIX.

DISEASES OF THE TONSILS.

Acute Tonsillitis.—Acute tonsillitis is an acute catarrhal inflammation of one or both tonsils. The inflammation may involve the crypts of the tonsils (lacunar or cryptic tonsillitis), the entire mucous membrane (superficial tonsillitis) or the mucous membrane and tonsillar tissue (parenchymatous amygdalitis). There is usually more or less general inflammation of the faucial mucous membrane.

Etiology.—Among the predisposing causes of acute tonsillitis are a general loss of tissue resistance due to uric acid condition of the blood, unhygienic surroundings, exposure to infectious organism, gastro-intestinal disorders and exposure to cold.

The exciting causes of inflammation of the tonsils are the streptococcus, staphylococcus and Eberth's typhoid bacillus. The avenue of infection is through the crypt of the tonsil, the lymph stream or broken-down epithelium of the tonsil.

Pathology.—With the localization of infection in the superficial form, we have a diffused redness, swelling and exudation of the serum, leucocytes and broken-down epithelium. With involvement of the crypts which are lined with the same kind of epithelium as the surface, we have a fibrinous exudation with necrosis of the epithelium appearing as a yellowish or white accumulation within the crypts. If cheesy deposits have existed within the tonsil previous to the acute inflammation, the secretion removed from the crypts will possess a foul odor. The orifices of the crypts are red and swollen in the early stages of the inflammation. The crypts are primarily the site of the inflammation in the lacunar form. In the parenchymatous form, there is a general inflammation of the glandular structure following the course of the blood vessels.

There is a general exudation of leucocytes and serum into the

tissue. If the infection is too profound, a phlegmonous abscess may form.

Symptomatology.—The conspicuous symptoms of the disease in young children may be high temperature, sometimes delirium, restlessness, loss of appetite and constipation. In adults, there is usually high temperature, general malaise, headache, backache, loss of appetite and painful swallowing. The disease may sometimes be usherêd in with a chill. The amount of temperature varies in individuals and is governed somewhat by the character of the infection. The temperature is much higher in children than in adults.

In the cryptic form, the disease sometimes simulates diphtheria. The absence of the Klebs-Löffler bacillus, high fever and rapid pulse will enable one to exclude diphtheria. The marked hyperemia extends high up on the pillars and over the pharyngeal wall.

In the cryptic form, the whitish exudation within the crypts is easily detected. The exudation may be very great or exceedingly small. In the latter condition, the inflammation is very superficial.

Mycosis can be differentiated by the history of the case, absence of infiltration and adherent fungus growths and no acute symptoms.

Ulcers of the tonsils resemble, in many respects, acute tonsillitis. In ulceration, we detect the well-defined area of necrosis either superficial or extending deep into the tonsil.

Mucous patches of the tonsil may sometimes be overlooked and treated for acute tonsillitis.

In inflammation of the tonsil from primary infection of syphilis, we have swelling of the tonsil, redness, infiltration of the lymph glands of the neck, history of slow onset of the disease and a circumscribed area of exudative necrosis and broken-down epithelium. The glandular tissue is somewhat hard to the touch. In some cases of hard chancre, we have temperature, fetid breath and anorexia.

The same symptoms continue day after day and do not react to local treatment. In the secondary stage of syphilis we may also have a pseudomembrane covering both tonsils, which should not be mistaken for acute tonsillitis.

Diagnosis.—The disease may be ushered in with a chill, followed by fever and burning pain in the region of the tonsils. The local

symptoms of distress increase with great rapidity. There is a dryness of the throat followed by an accumulation of mucus and a desire to swallow.

Course and Prognosis.—Acute tonsillitis usually runs its course in from four to ten days. The disease is contagious and the contagion may be thrown from the throat in a fine spray which is emitted from the mouth during speech, or the mucus and exudate, after being expelled, may dry and be disseminated about the room and inhaled by other members of the family.

The prognosis is favorable as far as life is concerned. The recovery may be slow, the disease becoming chronic in character with more or less involvement of the cervical lymphatic glands.

Treatment.—The treatment varies according to the pathology of the disease. Free purgation with fractional doses of calomel, followed by some aperient water, is usually indicated early in the disease. Patients should usually be confined to bed.

Regardless of the form of the tonsillitis, the throat should be sprayed with a warm Dobell's or Seiler's solution, four or five times daily.

In simple inflammation of the tonsils, a gargle composed of the following should be used every three or four hours:

℞	Zinci phenolsulphonatis,	1.80 gm. (gr. xxx)
	Boro-glyceridi,	30.00 c.c. (℥ i)
	Glycerini,	15.00 c.c. (℥ ss)
	Aq. destill., q. s. ad.	90.00 c.c. (℥ iii)

Signa. One teaspoonful to be added to two tablespoonfuls of hot water and used as a gargle every two or three hours.

Topical applications once daily of nitrate of silver or chlorid of zinc, twenty grains to the ounce, should be made. Aconite, in one drop doses every hour for the first twelve hours, is given for the relief of the temperature and as a stimulant of the vaso-constrictor.

For rheumatic or gouty diathesis in the adult, salicylate of soda or asperin in ten grain doses should be given every three hours for twenty-four hours.

In the cryptic form of the disease, the patient should be instructed

to use a gargle consisting of peroxid of hydrogen and extract of witch hazel in equal parts, every three hours. The diseased crypt on the tonsil should be touched with a fifty per cent. solution of trichloracetic acid or guaiacol on a cotton-tipped probe once daily.

For interstitial tonsillitis, the treatment consists in a hot antiseptic gargle, internal administration of salicylate of soda, relief of any gastro-intestinal disorders, and local application to the tonsil of a solution of nitrate of silver, sixty to one hundred and twenty grains to the

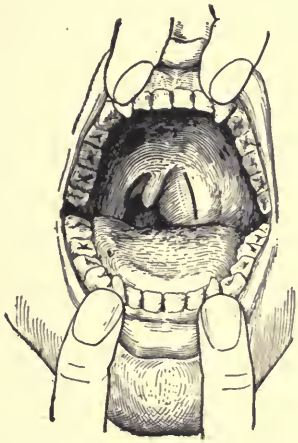

FIG. 144.—EVACUATION OF A TONSILLAR ABSCESS. (After *Veau.*)

ounce. In the application of a strong solution of nitrate of silver to the tonsil, great care should be taken to apply the solution gently to the tonsil and avoid contact with the larynx or pharynx. The throat should be frequently sprayed with acetozone inhalent. If the pain is excessive in interstitial tonsillitis, a deep incision of the tonsil, which may be followed by free hemorrhage, will lessen the engorgement and predispose to a rapid amelioration of the symptoms. With the formation of pus there is a throbbing, beating pain and fluctuation upon palpation.

The treatment is necessarily surgical and consists in the free evacuation of pus with a deep incision of the tonsil inward and upward, under antiseptic precautions, followed by hot antiseptic gargles.

Chronic Tonsillitis.—Chronic tonsillitis is a chronic inflammation involving the superficial and deeper structure of the tonsils, resulting from recurrent acute attacks of the same disease in which complete recovery has failed to take place.

Etiology.—Among the important causes of the disease are gastro-intestinal disorders, rheumatic diathesis, neglect on the part of the patient to secure medical attention in acute conditions or to carry out systematic treatment, climatic conditions, exposure to irritating gases, tobacco smoking and a tubercular diathesis. Within the crypts of the tonsils will frequently be found plugs of broken-down epithelium and glandular excretion, containing bacteria. The toxins eliminated are a constant source of irritation not alone to the tonsils proper, but also to the pharyngeal and laryngeal mucous membrane.

Course and Prognosis.—The disease may continue as a constant source of irritation with more or less exacerbations for months.

The prognosis is very good as far as recovery is concerned. Sometimes local and constitutional treatment have but little effect in curing the condition, while the symptoms are quickly relieved by a change to a dry, warm climate.

The presence of chronically inflamed tonsils is a constant menace to the general health, predisposing the patient to rheumatism, endocarditis and tuberculosis. It is quite true that many of the pathogenic or infectious organisms may find lodgment in the tonsils and be taken up by the blood or lymph stream and carried to some other distant organ, where they multiply and produce inflammation.

Pathology.—The disease is primarily due to successive attacks of acute inflammation from faulty systemic metabolism or the presence of attenuated organisms; there is more or less hypertrophy or hyperplasia of the mucous membrane and gland structures. The epithelial lining of the small mucous glands may, from continued irritation, become hypertrophic and finally atrophic, the normal secreting function being partially or completely destroyed.

Diagnosis.—There may be little or no enlargement of the tonsils. The hyperemic discoloration may be confined to the tonsil or invade the pillars, extending far up toward the median line of the soft palate.

The crypts of the tonsils will be found full of offensive debris, containing bacteria. By making pressure on the tonsil or lifting the anterior pillar, offensive plugs may sometimes be exposed.

There is usually a history of acute exacerbations of the disease and constant accumulation of mucus in the throat.

The voice may be impaired by the catarrhal inflammation and chronic enlargement of the tonsils.

Treatment.—The treatment of all chronically inflamed tonsils, large or small, is usually surgical and consists in complete extirpation of the tonsils.

The entire glandular structure, especially that within the supra-tonsillar fossæ, should be removed. For this we may choose the knife, snare, cautery, loop or scissors. It will first be necessary to dissect the supra-adhesion of the tonsil and only by so doing can we expect to completely remove the disease (see operations for removal of tonsils).

When radical measures are refused, the crypts may be emptied and destroyed with the galvano-cautery or trichloracetic acid in full strength. By a slow process of puncturing with the galvano-cautery, the tonsils may often be substantially reduced in size. Surgical measures for the removal of fibrous tonsils are frequently followed by severe hemorrhage and acute inflammation with hemorrhagic extravasation into the surrounding tissue.

The inflammation and pain may continue for four or five days. The wound should be cleansed twice daily with peroxid of hydrogen and swabbed once daily with a five per cent. solution of nitrate of silver on a cotton-tipped probe.

Hot Dobell's solution should be used as a gargle every two hours. The patient should remain in-doors as much as possible to prevent additional infection.

There is frequently a chronic follicular pharyngitis with varicosities which should be removed by touching with the actual cautery. The constitutional treatment is devoted to the relief of any existing diathesis. Suppurative foci in the nasal cavity should be removed, decayed teeth must be extracted or filled. The local treatment consists of the frequent use of hot antiseptic gargles and the bi-weekly application

to the tonsils of a 10–20 per cent. solution of the nitrate of silver on a cotton-tipped probe.

Membranous Tonsillitis.—The general pathology of membranous tonsillitis is the same as that for acute follicular tonsillitis. The exudation is more profuse than in acute follicular tonsillitis and undergoes a coagulation necrosis, with elimination of toxins.

Treatment.—The treatment consists in avoiding, as far as possible, general infection from local conditions by the administration of calomel in one-tenth grain doses every hour until purgation results,

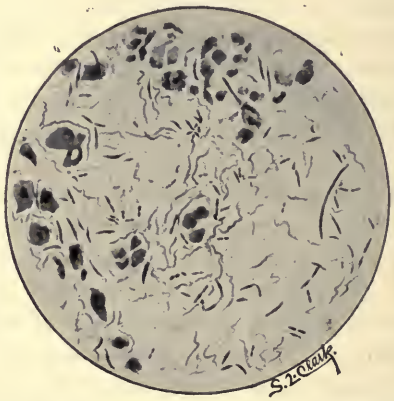

FIG. 145.—SPIRILLUM OF VINCENT AND THE FUSIFORM BACILLUS; OTHER ORGANISMS ARE ALSO PRESENT. (*Coplin after Rosenberger.*)

followed by spraying the throat with hydrogen peroxid and local application of Löffler's solution and the internal administration of iron and quinin in tonic doses.

Vincent-Plaut Angina.—Vincent-Plaut angina is an irregular ulceration of the tonsil, characterized by the formation of a thick and adherent membrane resembling the necrotic membrane of diphtheria.

Etiology and Pathology.—The disease is due to infection of one or more follicles of the tonsil with a fusiform bacillus and Vincent's spirillum (see Figure 145). The disease is closely related to ulcero-

membranous stomatitis and purulent diseases of the alveolar process. The ulceration may also be located upon the cheek, uvula or soft palate.

The disease is infectious in character and can be transmitted in the act of talking or coughing.

The membrane is adherent to the ulcerated surface and, when detached, leaves a bleeding and granular surface. The surrounding tissues are somewhat infiltrated with inflammatory exudates. However, the tonsillar structure may be only slightly swollen and infiltrated.

Symptomatology.—The patient usually complains of elevation of temperature, general malaise, irritation in the region of the tonsils and painful swallowing. The glands of the neck on the affected side may become swollen and tender to the touch.

Course and Prognosis.—Under local treatment, the disease usually runs its course in from ten to fifteen days. The disease gradually disappears leaving a well defined excavation at the site of the ulceration.

Diagnosis.—Vincent-Plaut angina resembles, in appearance, diphtheria, the ulceration of syphilis or streptococcic or staphylococcic infection. Upon examination, a circumscribed or irregular necrotic and grayish spot is seen upon the tonsil. The periphery of the membrane is slightly elevated above the tonsillar surface and the center of the ulcer slightly depressed. More careful examination will show the membrane to be more or less adherent. When detached, it leaves a bleeding and worm eaten surface. The membranes continue to reform and not until the ulcer is completely healed will all evidence of the necrotic membrane disappear. The lymphatic glands of the neck will be swollen and tender to the touch. The temperature is variable and may range from slightly above the normal to 102°.

Treatment.—The general treatment is directed toward securing thorough cleanliness of the alimentary tract and careful dieting of the patient.

The local treatment consists in washing the throat with Dobell's solution and the application of peroxid of hydrogen on a cotton-tipped

probe to the ulcer. Afterward the ulcer should be cleansed and as much of the necrotic membrane removed as possible with forceps.

The ulcer should then be touched lightly with a fifty per cent. solution or trichloracetic acid. This form of treatment should be continued until complete recovery.

Rheumatic or Gouty Tonsillitis.—This is an acute or chronic inflammation of the tonsils resembling acute or chronic catarrhal tonsillitis, occurring in individuals suffering from uric acid diathesis, with or without local manifestation of the disease other than in tonsillitis.

Etiology.—According to the investigation of Cline and others, a lithemic diathesis may be inherited or acquired and the condition results from gastro-intestinal disorders, over-indulgence in alcoholic liquors and nitrogenous foods, sedentary habits and nervous exhaustion. There may be a like inflammation of the pharyngeal mucosa.

Symptomatology.—In the acute form, the disease is sudden in its onset and frequently subject to nightly exacerbations. The acute symptoms may entirely pass away during the day and appear at night. An irritating cough may intervene at night, interrupting sleep.

In the chronic form of the disease, deposits of sodium urate may sometimes be observed about the finger joints. Throat symptoms of the disease may be the preliminary sign of an approaching arteriosclerosis. The symptoms may continue from a few days to a number of weeks.

Diagnosis.—The diagnosis is by a process of exclusion. With the history of symptoms enumerated above, diagnosis is easy. The urine is highly colored and acid. The diagnosis of rheumatic tonsillitis is based upon symptoms of rheumatism in other portions of the body and inability to cure the disease with local medication.

Treatment.—In addition to the local treatment, the attention should be directed to the removal of the rheumatic diathesis. This is done by the avoidance of all foods which tend to produce uric acid, such as meats, coffee, tea, tobacco and alcoholic liquors. The eliminating organs may be stimulated by hot baths and light exercise. Distilled or lithia water should be consumed in great quantities and, in addition, granulating phosphate of soda, in teaspoonful doses in water,

should be given night and morning. Aspirin in ten grain doses is peculiarly efficacious in producing free perspiration and the elimination of uric acid.

The local treatment consists in spraying the throat with alkaline antiseptic spray, applications of protargol in twenty per cent. solution, and gargling with hot milk. Massage acts as a sedative and stimulant.

Patients of sedentary habits should be encouraged to spend a great deal of time out of doors in mild exercise, golf, horseback riding, canoeing, etc.

Herpetic Tonsillitis.—Herpetic tonsillitis is characterized by the formation of herpetic vesicles over the surface of the tonsils. Herpes zoster of the face may occur following herpes of the throat or simple infection of the throat, as observed by Doplir, who reports an epidemic of herpes zoster of the inferior maxillary branch of the fifth nerve.

Treatment.—The treatment is directed to the building up of the general system. Local applications of compound tincture of benzoin and fifty per cent. boro-glycerin (D. Braden Kyle), followed by spraying with a two per cent. solution of campho-menthol in albolene, twice daily, are indicated. For the relief of headache, fever, etc., the following is recommended:

℞	Quininæ bromidi,	.18 gm. (gr. iij)
	Phenacetini,	.18 gm. (gr. iij)
	Creasoti (beechwood),	.12 c.c. (gtt. ij)
	Pepsin puræ,	.06 gm. (gr. j)

M.

Signa. To be repeated in four hours.

Actinomycosis of the Tonsils.—Thanks to the investigations of Jonathan Wright (*American Journal of Medical Sciences*, July, 1904), The Laryngologist is given an exceptional description of the pathology of this disease. Literature, possibly from the rarity of the condition, is barren of more than a general account of actinomycosis of the tonsils.

A great many clinicians have observed the disease infecting the

glands of the neck, but few have reported the condition limited to primary involvement of the tonsils.

Pathology.—The pathology of actinomycosis of the tonsils is identical with that of actinomycosis of the glands of the neck, the skin, intestinal canal, esophagus or lungs. The entrance of the germs into the mouth is through food, grain, wood or air. It is presumed that the ray fungus must pierce the epithelium before propagation and, therefore, trauma sufficient to interrupt the epithelium is necessary to the infection. Decayed teeth may harbor the organism and on account of the warmth of the tooth cavity and nourishment gained from the secretion of the mouth, the organism may, after a long time, find lodgment within the crypts of the tonsil.

Symptomatology.—The symptoms of the disease are the same as those of granulating abscess without the pain of abscess and inflammation and general systemic infection. The abscess-like condition may involve one or more crypts. Actinomycosis is usually discovered by accident, as no one conspicuous symptom causes the individual to consult the laryngologist other than enlarged tonsils and nasopharyngeal catarrh, which may be present.

Diagnosis.—We may or may not have a history of injury of the throat from a straw, wood or particles of grain violently thrown into the throat during threshing, etc. The entrance of the ray fungus into the broken-down epithelium brings about a low form of inflammation characterized by swelling of the tonsils and the formation of nodules, which, in time, undergo fatty degeneration and ulceration, with the formation of pus containing yellow granules. The degenerated foci may be connected by the sinuses and may be discovered by a blunt, curved probe. Proliferating epithelium or granulating tissue may line the cavity and may be distinguished by the naked eye. It is this process, as observed by Jonathan Wright, "which probably accounts for the absence of lymphoid infiltration in adjacent tissue, which is so frequently observed in other inflammatory diseases of the tonsils." Metastatic infiltration may occur. If so, it is usually from a direct rupture into the blood vessel (Ziegler).

Treatment.—The immediate removal of the tonsils is indicated, which can be done with a blunt tonsil knife or tonsillotome. When

this cannot be done, the application of the galvano-cautery direct to the nodules or ulcerated surface is the best form of treatment. According to Wright, in the absence of the galvano-cautery, iodid of sodium has an inhibiting influence on the growth of the actinomycosis. Diseased teeth should be removed for fear they may still harbor the organism and predispose to a second infection.

Cholesteatoma of the Tonsils.—Cholesteatoma of the tonsils is a cheesy-like and ill-smelling mass containing cholesterin within the crypts or pockets of the tonsil, due to a process of metaplasia.

Etiology and Pathology.—To Norval H. Pierce the credit is due for a complete history of pathological findings and an accurate description of the disease. According to Pierce, the condition is more often found in the supratonsillar fossæ and is "produced by exfoliations of epithelium, faulty degeneration and finally decomposition of the mass."

Symptomatology.—The symptoms vary but little from those of chronic tonsillitis. Pierce reports that after the removal of the tonsils for continued irritation, the patient continues to complain of distress and laryngeal irritation, until the sinus in the upper portion of the tonsil and between the tonsillar fossæ is cut away.

Treatment.—In addition to the removal of the tonsils, the treatment consists in the destruction of the crypts of the tonsil with the galvano-cautery.

Peritonsillar Abscess or Quinsy.—A peritonsillar abscess or quinsy is an acute localized suppurtive inflammation within the tissue surrounding the tonsils. The infection is usually confined to one side. That portion of the tissue anterior and above the tonsil is more frequently involved.

Etiology.—The disease occurs more frequently in men than in women and results from traumatism, exposure to inclement weather and rheumatic diathesis. Adherent tonsils form artificial culture tubes, favorable for the propagation of pathogenic organisms, which may, under favorable conditions, penetrate the surrounding tissue with the formation of an abscess.

Pathology.—A localized abscess in the peritonsillar region is more frequently due to the streptococcus pyogenes aureus or albus which

find access to the tissue by the lymph stream or intracellular spaces. The severity of the localized necrosis is dependent upon the predisposing cause.

Pus points in the direction of least resistance and the abscess ruptures if left alone. The size of the abscess varies in individuals.

Symptomatology.—In the formation of a peritonsillar abscess, we have all the symptoms of a localized inflammation in a variable degree, redness, heat, pain, swelling and loss of function.

The disease may be ushered in by a chill followed by fever, headache, general malaise and great distress in the throat. The pain and discomfort in the throat increase very rapidly, often becoming almost unbearable. The swelling and pain may become so great as to prevent the patient's mouth being opened for more than a few millimeters. The area of localized inflammation can be well observed after twenty-four hours and the tissues are very dense to the touch. There is a general, catarrhal inflammation of the fauces with an accumulation of mucus. The tongue appears thick and heavily coated, the teeth are covered with dried mucus and the breath is fetid. The temperature may range from 102° to 105° F. The disease may resemble the clinical symptoms of diphtheria, and in doubtful cases a culture should be made.

Diagnosis.—Deep throbbing pain in the region of the thoat, difficult swallowing and rapidly increasing symptoms of inflammation in adults are suggestive symptoms of peritonsillar inflammation. With natural sunlight, a head mirror and tongue depressor, the redness and swelling of the tissues, anterior, posterior and above the tonsil, can be detected. It is sometimes very difficult to differentiate a general inflammation of the tonsils in which the anterior pillar is in close contact with an enlarged tonsil, from a peritonsillar abscess. The inflammation usually extends upward, producing marked swelling of the approximal side of the soft palate and edema of the uvula. The area of infection can be detected by the finger, if the disease is far advanced. The swelling will be nodular before necrosis has begun. With the formation of pus, the swelling will become elastic and fluctuating.

Course and Prognosis.—The disease usually runs its course in from

four to eight days. As a rule, there is a complete cessation of all symptoms and an early recovery upon the evacuation of pus. A second infection or reinfection sometimes occurs in cases in which the pus was not entirely evacuated.

As far as life is concerned, the prognosis is good. Dyspnea from obstruction may occur or strangulation or death from asphyxia from spontaneous rupture into the larynx during sleep, should the pus gravitate into the deeper tissue of the neck. Death may occur unless the area of infection can be located and removed; if not, a general, spreading, infectious inflammation more frequently supervenes, producing death.

Treatment.—In the beginning of the disease, free purgation with calomel et sodium is indicated, followed by large doses of benzoate or salicylate of sodium, three times daily. For the abolition of the inflammation in the very beginning of the trouble, tincture of aconite in one drop doses should be given every hour until the constitutional effect of the drug is secured. Dry heat externally is especially indicated at any stage of the disease. The nose and throat should be frequently sprayed with Dobell's solution. For the pain and distress, especially at night, Dover's powders or morphia should be given.

As soon as pus can be detected by palpation or by the eye alone, a deep incision should be made in the peritonsillar structure, upward and inward, toward the base of the uvula. As a rule, as soon as the pocket of pus is reached, blood and pus can be seen escaping. The incision should be sufficiently large to allow perfectly free evacuation of the abscess cavity.

The after-treatment is directed to keeping the mouth and throat as free as possible from infection, and the stimulation of repair by hot antiseptic gargles. The salicylates should be continued for a few days, followed by some alterative and tonic.

Operations for the Removal of the Tonsils.—The indication for the removal of the tonsils is, as a rule, quite well defined. With the introduction of cocain, stovain and adrenalin and comparative freedom from the danger of strong solutions of cocain or stovain, numerous methods of dissection have come into favor. The simple removal of the mass of tonsil protruding beyond the anterior pillar,

is practically an operation of the past and especially is this true of patients past the age of infancy. The complete extirpation of the tonsil, or tonsillectomy, is the most satisfactory and scientific operation. There is a discrepancy of opinion relative to the most efficient tonsil-

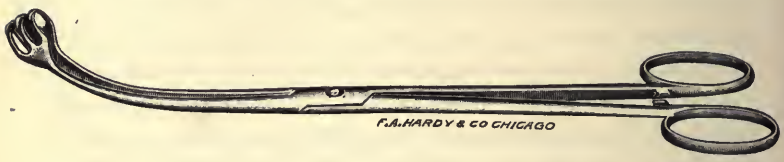

FIG. 146.—BALLENGER'S TONSIL FORCEPS.

lotome. The Mathiews and McKenzie are more frequently used. Personally, the author prefers the McKenzie (Fig. 149). In addition to the tonsillotomes, there is the punch forceps, recommended by Myles, Rault, Rhodes and others, the scissor by Robertson (Fig.

FIG. 147.—BECK'S PILLAR SCISSORS.

150), the electro-cautery by Pynchon, the ecraseur by Ballenger, the wire snare and the electro-cautery.

Quite frequently the pillars of the tonsils are adherent and overlapping the tonsil proper, thus preventing an exposure of the tonsil. For the dissection of the pillar, the scissors designed by Joseph C.

Beck (Fig. 147), Holmes turbinal scissors, and the knives designed by Pynchon (Fig. 148), are of great service. On account of the submerged condition of the tonsil, a tenaculum or lifting forceps is nec-

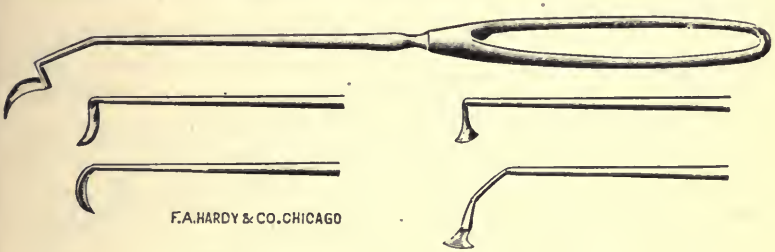

FIG. 148.—PYNCHON'S TONSIL KNIVES.

essary and the one designed by Ballenger (Fig. 146), which is slightly curved, is more practical than a straight forceps.

In the great majority of cases, some form of anesthetic is necessary

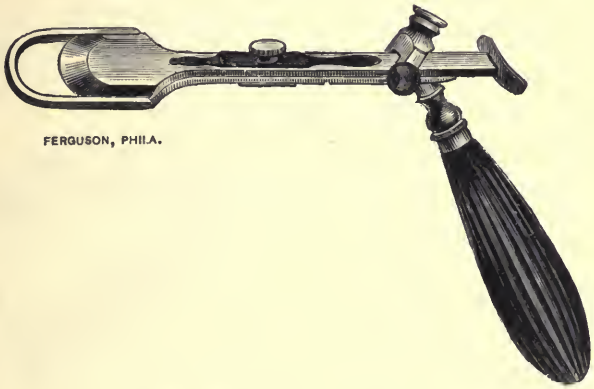

FIG. 149.—MCKENZIE'S TONSILLOTOME.

and our choice is with cocain, stovain, chloroform, ether or ethyl-bromid. If the individual is of a highly nervous temperament, regardless of the complete anesthesia secured by cocain, results are frequently unsatisfactory. If more than a few seconds are required for the dissection of the pillar and the removal of the adenoid growths,

chloroform is indicated. Profound anesthesia is unnecessary. If only a few seconds are required for the operation, Merk's ethyl-bromid has proved an ideal anesthetic with the author (see Anesthesia, p. 161).

With a Mathiew's or McKenzie's tonsillotome, tonsillotomy consists in first separating the pillars from the tonsils (if a young child, a mouth gag is necessary) and grasping the tonsils with a Ballenger forceps, previously passed through the foramen of the tonsillotome, the tonsil is lifted from its bed, the tonsillotome is pressed home and the growth is removed as near its pedicle as possible. The hemorrhage following is usually controlled with an iced Dobell's solution or gargle of tannic acid and water. The hemorrhage may be profuse and demand some radical procedure. There is ligation of the external carotid artery, stitching of the pillars, cautery and tonsillar hemostat. In severe hemorrhage, the tonsillar hemostat (Fig. 151) is usually sufficient. This should remain in position from one-half to one hour. In a bleeder with a manifest hemorrhagic diathesis, the tonsillar hemostat should remain for a longer time. The hemorrhage occurs more often after the patient has left the operating room and has made undue movement. Syncope may occur and is nature's method of clogging the vessel.

The diet for the first twenty-four hours should be a cold, liquid one. Afterward, the ordinary diet may be prescribed.

The local treatment consists in frequently gargling the throat with iced Dobell's solution. Recovery is usually complete within a week.

The removal of the tonsils with a cold snare differs in no way in practical results from the removal with the tonsillotome. It is argued that hemorrhage is less liable to occur with the snare. This is quite true in many cases, but severe hemorrhages following the use of the snare are reported. For the complete extirpation of the tonsil, the cautery dissection, as performed by Pynchon, is ideal. In the hands of a novice, the tonsil may be completely destroyed, but there usually remains a distinct scar in the pillar, which, to say the least, is unsightly and unbecoming to behold.

Pynchon's cautery dissection is performed under a twenty per cent. cocain anesthesia with a cautery point heated to a bright cherry

red. The tonsil is then grasped with a pair of tonsil forceps and posterior and anterior portions of the tonsil are dissected away from

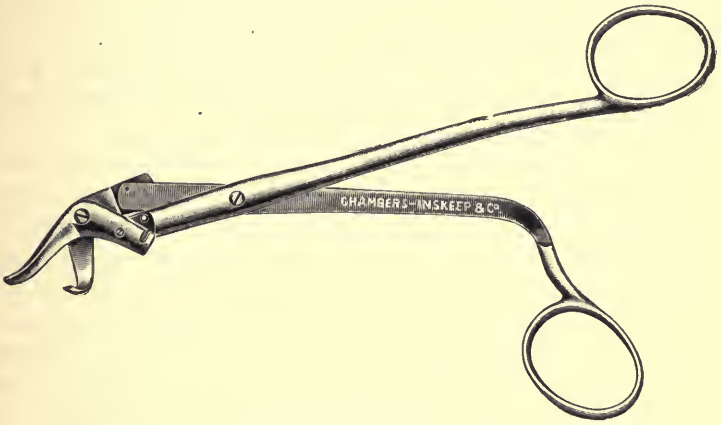

FIG. 150.—ROBERTSON'S TONSIL SCISSORS.

the anterior pillar. Following this, the tonsil is dissected away from the posterior pillar.

In Pynchon's cases, after a few weeks, the pillars are singularly

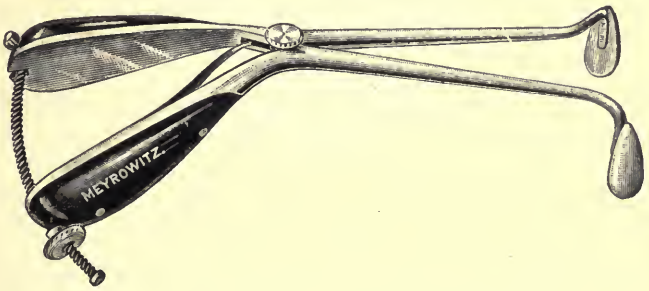

FIG. 151 —BUTTS'S TONSILLAR HEMOSTAT.

free from scars, and from the general appearance seem quite normal.

The Robertson scissors resection (Fig. 150) consists in securing a complete local anesthesia, preferably by injecting into the tonsils

15–20 drops of 10 per cent. solution of stovain in an equal part of adrenalin chlorid and distilled water, dissection of the pillars, elevation of the tonsils and their removal with scissors. A right and a left scissors are designed by Roberts. The hemorrhage is sometimes quite profuse following the excision of the tonsils. The patient should be put to bed and instructed to gargle the throat every hour for twelve hours with iced Dobell's solution.

The tonsil punch is especially designed for the removal of small, cryptic tonsils.

Reduction of the tonsils by the electro-cautery is sometimes advocated in hemophilic subjects and in those who object to other operative measures.

The technique of the operation consists in thoroughly cleansing the nose, naso-pharynx and pharynx with some antiseptic and alkaline solution. The tonsils should be anesthetized with a twenty per cent. solution of cocain. The cautery point is heated to a pale cherry red and driven deep into the tonsil or carried partially through the tonsil. It may be necessary to make more than one puncture and at a week's interval. The amount of slough and shrinkage corresponds to the amount of tissue destroyed by the cautery. If the tonsil is a hard and fibrinous one, the pain may be quite severe for a few hours following the operation.

The after-treatment consists in gargling the throat twice daily with a hot antiseptic solution.

Barring the time required, the results from tonsil cauterization are frequently as satisfactory as by any other method.

CHAPTER XXX.

DISEASES OF THE LINGUAL TONSIL.

Acute Inflammation of the Lingual Tonsil.—Acute inflammation of the lingual tonsil is an acute inflammation of the mucous membrane and glandular structure situated at the base of the tongue and may be unilateral or bilateral.

Etiology.—The predisposing cause is injury from chemical substance, foreign body or constitutional dyscrasia.

FIG. 152.—HYPERTROPHY OF THE LINGUAL TONSIL. (After *Gruenwald.*)

The exciting cause is some pathogenic organism which may be carried to the parts by the foreign body producing the injury or from contiguous parts.

Pathology.—The pathology of the disease is the same as that of acute faucial tonsillitis.

Treatment.—The local treatment consists in the application of nitrate of silver, twenty to thirty grains to the ounce, once daily, followed by a spray of a two per cent. solution of campho-menthol in

albolene. Hot antiseptic gargles should be prescribed for home use with the instructions to be used every two or three hours with the nose tightly closed while gargling.

The constitutional treatment consists in securing free catharsis by the administration of calomel. Benzoate or salicylate of soda is usually indicated in from ten to fifteen grain doses, three times daily, well diluted in water.

Hyperplasia or Hypertrophy of the Lingual Tonsil.—*Etiology.*—Hyperplasia of the lingual tonsil is due to an inherited tendency to the disease, chronic faucial tonsillitis, gastro-intestinal disorders, rheumatism, gout, syphilis and excessive use of tobacco and alcoholic liquors.

Pathology.—There is an increase in the size of the tonsil, usually bilaterally, which is due to an increase of lymphoid and connective tissue.

Symptomatology.—The symptoms vary greatly in individuals. One of the distressing symptoms frequently produced by hyperplasia of the lingual tonsil is a constant cough. In addition to this, the patient may complain of an accumulation of mucus in the throat, sensation of fullness and constriction about the larynx. On account of the pressure upon the epiglottis, there may be some disturbance in phonation and respiration, hacking cough and the desire to clear the throat.

Hemorrhage from the tonsil may result from rupture of varicosities due to excessive coughing or traumatism.

Diagnosis.—Upon inspection with the laryngoscope with the tongue turned out as for laryngoscopic examination, the enlarged lymph glands about the base of the tongue are easily detected. In obstinate cases of cough, sensitive areas may sometimes be detected with a curved, cotton-tipped probe, and when touched, produce violent spasms of coughing.

Treatment.—The treatment consists in the correction of any constitutional dyscrasia and the removal of lymphoid hypertrophies by surgical methods or with the galvano-cautery.

For the surgical removal of lymphoid hypertrophies, Roe's lingual tonsillotome may be used. The technique of the operation consists

in securing local anesthesia with a twenty per cent. solution of cocain or equal parts cocain, menthol and carbolic acid. Under good illumination, Roe's tonsillotome can be passed into the throat, easily engaging the hypertrophy. By a steady pressure upon the blade, at the same time making firm pressure against the base of the tongue with the instrument, the hypertrophies are easily removed.

The after-treatment consists in cold antiseptic gargles for the first twenty-four hours, followed by hot antiseptic gargles. The galvanocautery is a highly expeditious instrument for the removal of hypertrophies.

Under good illumination and local anesthesia of twenty per cent. solution of cocain, the electrode may be passed into the throat and directly against the lymphoid hypertrophy, when the current is turned on. A number of applications may be made at one sitting. There is very little or no reaction and the recovery from the cauterization is usually very rapid.

Abscess of the Lingual Tonsil.—Abscess of the lingual tonsil is due to traumatism or metastasis followed by infection from some pathogenic organism, often the streptococcus or staphylococcus.

Pathology.—The pathology varies in no wise from retropharyngeal abscess or abscess of the tonsil.

Symptomatology.—The patient complains of swelling at the base of the tongue, difficult swallowing, rise of temperature, headache, and general malaise. The area of infiltration is easily detected upon inspection. If the swelling becomes too great, protrusion of the tongue and examination of the fauces become exceedingly difficult. There is usually redness of the pillars and an accumulation of mucus in the throat. The site of the abscess is usually to the right or left of the median line and at the base of the tongue. The formation of pus in the lingual tonsil is usually somewhat slower than in the faucial tonsil. Pain gradually increases in intensity and may continue from three or four days to a week. The abscess sometimes ruptures spontaneously.

Diagnosis.—On account of the swelling at the base of the tongue and the inability to open the mouth, it is frequently impossible to diagnose the presence of pus by palpation. In two cases of abscess

of the lingual tonsil treated by the author within the last year, it was impossible to locate the pus on account of the intense swelling, and, in consequence, the abscess in both cases ruptured spontaneously.

It is necessary to differentiate the disease from peritonsillar abscess or abscess of the tonsil. The disease may occur at any age, but is seen more often in the young.

Treatment.—The treatment is directed to securing a free evacuation of the bowels by the administration of calomel, followed by a saline cathartic.

One-fourth grain doses of codein may be given every three hours for the relief of pain. In addition, ten grains of salicylate of soda should be given three times daily.

The local treatment consists in hot antiphlogistin measures externally and hot saline and antiseptic gargles. As soon as the pus is detected, it should be incised under twenty per cent. cocain anesthesia with a curved bistoury. If the swelling is not too great and the jaws move freely, the knife can be guided into position with the index finger of the other hand. Should the abscess rupture spontaneously, the patient should be instructed to use hot antiseptic gargles until all sensations of irritation in the throat have passed away.

Mycosis of the Tonsil.—(See Mycosis of the Pharynx.)

Lingual Varix.—Lingual varix is a condition of varicose veins of the lingual tonsil.

Etiology.—The disease may accompany hyperplasia of the lingual tonsil and is more often observed in rheumatics, syphilitics and in those addicted to the excessive use of alcoholic liquors. The condition is sometimes observed in individuals of a hemorrhagic diathesis.

Pathology.—The pathology is the same as for varicosities in any other portion of the body.

Symptomatology.—The symptoms of the disease vary in individuals. Large varicosities may sometimes exist without any irritation to the patient. In other cases there may be a feeling of irritation at the base of the tongue, constant cough and at times a hemorrhage.

Diagnosis.—Upon inspection with the laryngoscopic mirror, the tortuous and swollen varicosities, extending antero-posteriorly on the

lateral halves of the base of the tongue, are readily discerned. In mild or severe hemorrhages from the throat, the possibility of ruptured varicosities at the base of the tongue should always be taken into consideration.

Treatment.—Under an anesthesia of a twenty to thirty per cent. solution of cocain, or carbolic acid, menthol and cocain in equal parts, the varicosities may be destroyed by the galvano-cautery. The point of the cautery should be heated to a cherry red and applied directly to the larger varicosities.

CHAPTER XXXI.

DISEASES OF THE LARYNX.

Acute Catarrhal Laryngitis.—Acute catarrhal laryngitis is an acute inflammation of the superficial layer of the mucous membrane of the larynx.

Etiology.—The cause is more often some gastro-intestinal disorder, exposure to cold, chronic interstitial tonsillitis, excessive use of the voice, and induration from irritating gases. Acute laryngitis may sometimes accompany scarlet fever, measles, malarial and typhoid fever.

Pathology.—There is a hyperemia and swelling of the mucous membrane and sometimes an edema and round cell infiltration. The edema is sometimes greater in children because of the loose connective tissue in the subglottic region. The disease is probably a vaso-motor disturbance due to faulty local nutrition and toxins eliminated from the system.

Symptomatology.—The symptoms vary according to the degree of inflammation. There is usually hoarseness, sometimes complete loss of the voice, and a dry, hacking cough. Where the voice is not entirely lost, it is dry and husky and sometimes reduced to a whisper. Children and the middle-aged are susceptible to the disease and those residing in a cold, moist climate are more often affected than residents of a dry, warm climate. On account of the character of the epithelium lining the larynx, there is a tendency for the inflammation to remain localized, but, however, the inflammation sometimes extends to the upper air passages and into the bronchial mucous membrane.

Diagnosis.—Variety and intensity of coloring will be observed in the mucous membrane and is in proportion to the edema and the severity of the inflammation. There may be a slight redness involving the epiglottis and mucosa of the superior ventrical region or a deep redness of the vocal cords and entire mucosa of the larynx.

Prognosis.—The prognosis of simple, acute, catarrhal laryngitis is usually favorable. The disease passes away in from a few days to a week, providing, of course, that the patient is not successively exposed to the influence or condition which produced the disease.

The vocal cords are usually covered with a thick glassy mucus, which is adherent and can be removed only with great difficulty.

Treatment.—The treatment is both local and general. The local treatment is directed to the relief of local congestion by the frequent inhalation of steam, medicated with the following:

℞	Menthol,	1.20 gm. (gr. xx)
	Ol. eucalyptus,	30.00 c.c. (℥ i)
M.		

Signa. Ten to fifteen drops should be added to a sponge in the simplex inhaler.

This treatment should be repeated for a period of fifteen minutes every two or three hours during the day. A gargle of hot Dobell's solution every hour will lessen the pain and dryness in the throat and, in the early stages of the disease, will aid in the relief of the congestion. Antiphlogistin or hot applications externally will act as a counter-irritant and aid in lessening congestion. In the adult, if the poultice is removed upon arising, the neck and chest should be bathed with cold water followed by the application of alcohol, and dried with a coarse towel.

In the severe form of the disease, the general treatment consists in confining the patient to a warm room. On account of the lessened tendency to edema of the larynx in the adult, the patient may be privileged to go about his business, provided, of course, there is no elevation of temperature and the patient can refrain from using his voice. In addition to the general treatment outlined above, the administration of calomel in one-tenth grain doses every hour until free purgation results, is indicated. The use of the voice should be prohibited for forty-eight hours, likewise smoking and the use of alcoholic liquors.

For the relief of the cough, an elixir of turpen-hydrate and heroin in one drachm doses should be given every three hours. If, after a day or two, the secretion adheres to the vocal cords, muriate of am-

monia, in three grain doses, should be added to the dose of elixir of turpen-hydrate and heroin.

Uric acid conditions of the system should be relieved by the free administration of distilled water and benzoate or salicylate of soda in ten grain doses, three times daily.

The office treatment consists in cleasing the larynx with a mild alkaline and antiseptic spray. For the cleansing of the larynx, the DeVilbiss laryngoscopic tube is indicated. Following the cleansing, the larynx should again be sprayed with the following:

℞	Zinci sulphatis,	.24 gm. (gr. iv)
	Glycerini,	1.00 c.c. (gtt. xv)
	Aquæ,	30.00 c.c. (℥ i)

This should be followed by a bland oil spray. If, after ten to fifteen days, the congestion of the mucous membrane of the larynx has not passed away, the parts should be painted with two to four per cent. solution of nitrate of silver every two or three days.

Chronic Catarrhal Laryngitis.—Chronic catarrhal laryngitis is a chronic catarrhal inflammation of the entire structure of the mucous membrane of the larynx and may be circumscribed or diffused.

Etiology.—Successive attacks of acute laryngitis are one of the prominent factors in the causation of the chronic form of the disease. With continued irritation from frequent attacks of acute laryngitis a general hypertrophic and hyperplastic condition results, involving the blood vessels, glands and mucosa, producing partial or complete alteration of function.

The disease is often slow in its onset, especially if dependent upon a chronic catarrhal condition of the nose and throat. Other causes to be especially enumerated are gastric disturbances, bad teeth, mouth breathing, alteration in normal nasal respiration, sexual excitement, diabetes, rheumatism, chronic purulent middle ear diseases, chronic, purulent inflammation of the accessory sinuses, prolonged exposure to irritating dusts, alcoholic excesses, inhalation of tobacco smoke, chronic faucial tonsillar affection, uterine and ovarian disorders and tuberculosis. In the last condition, patients irritate the larynx by continued coughing and expectorating. Orators and public speakers often suffer from the disease from prolonged use of

high tension speech and persistent use of the falsetto register. Age, heredity, sex and climatic conditions each play a small part in predisposing to the disease. Age has its influence only to this extent, that systemic disturbances are more prone to occur between the ages of thirty and fifty, and in consequence, at this period of life, the disease is more prevalent. Many children suffer from inherited dyscrasia, which retards their healthy growth and thus predisposes them to this disorder. On account of the exposure incident to their occupations, men suffer more frequently from the disease than women, especially in damp climates.

Pathology.—On account of the many causes enumerated above, it can be readily understood that it is possible to so retard the recovery of an acute inflammation or change a hyperemic condition of long standing of the larynx into a chronic condition, involving all the structures of the mucosa. On account of the longevity of the disorder, the blood supply from altered vessel walls becomes diminished. Hypertophy of the surrounding tissue may cause an obstruction to the return of venous blood, producing a passive hyperemia. The glands which supply the lubricating fluid to moisten the vocal cords often become altered and give rise to a lessened secretion which causes a dryness of the true and false cords, or there may be just the reverse, a hypersecretion. A variety of hyperplastic changes are noted in the mucosa and an irregular thickening described by Virchow as "pachydermia laryngis," are sometimes observed.

Symptomatology.—If the disease is the result of acute laryngitis, there is a prolonging of the hoarseness, hacking cough, general sense of irritation in the throat and frequent expectoration. The voice will be much clearer in the morning, the hoarseness becoming more pronounced toward evening or after using the voice.

The alteration in the voice is sometimes out of proportion to the visible change in the laryngeal structure. A certain amount of respiratory effort is required for distinct phonation, which causes the patient to complain of fatigue in the chest.

Diagnosis.—The diagnosis of chronic catarrhal laryngitis is comparatively easy. All those conditions which may directly produce a loss of voice, such as paralysis, tumors, aneurism and incipient pul-

monary tuberculosis should not be overlooked in reaching a positive diagnosis.

The pillars of the fauces, uvula and tonsils often show a thickened and chronically inflamed appearance. The pharyngeal wall is likewise inflamed and covered with varicosities and follicles. Examination of the larynx will usually show a general hyperemic condition of the mucosa and vocal cords. The color of the vocal cords varies in individuals from a flesh pink to a deep red.

The hoarseness is due to a partial loss of function of the cords or hypertrophy of the muscle assisting in phonation.

A muco-secretion is usually thrown off, which causes frequent hawking and expectoration.

Course and Prognosis.—The course of the disease is usually varied. The disease may continue for a very long time, ending in spontaneous recovery with a removal of the exciting cause.

The voice seldom regains its normal timbre after a prolonged exposure to a chronic catarrhal inflammation.

The disease is not dangerous to life, only to the extent that there is a predisposition to laryngeal tuberculosis and morbid growths of the larynx.

Treatment.—The treatment is both local and constitutional. Before making any local application, the naso-pharynx and laryngo-pharynx should be freed with laryngeal spray of any catarrhal exudation. Local applications are best made to the larynx with a curved laryngeal applicator or through the medium of sprays. In using an aqueous spray, the patient should be instructed to protrude the tongue and deeply inspire the spray. Oil spray or nebulizer can be advantageously used. The patient can draw the nebuli of oil deep into the larynx without bringing about a spasm of coughing. As an oil spray in chronic catarrhal laryngitis, there is nothing better than the following:

℞	Iodin,	.06 gm. (gr. i)
	Oil of pine,	.30 c.c. (gr. v)
	Campho-menthol,	.90 gm. (gr. xv)
	Ol. gaultheriæ,	.30 c.c. (gr. v)
	Albolene,	30.00 c.c. (℥ i)

One teaspoonful of compound tincture of benzoin to a pint of boiling water is highly efficacious for inhalation. The patient can use one of the cheap inhalers now on the market. Local applications should be made for fifteen to twenty minutes, three times daily, one-half hour before going out of doors.

As an aqueous spray, some of the milder astringents, such as tannic acid, sulphate of zinc, phenolsulphonate of zinc, copper or hydrastis in from one to five per cent. solution may be prescribed.

As a topical application for the treatment of the chronic catarrhal inflammation, one to five per cent. solution of nitrate of silver is often used. Under good illumination from a head mirror, or in many cases under direct sunlight, with the tongue extended exposing the tip of the epiglottis, a small curved, cotton-tipped probe can be passed directly into the larynx. A spasm of the larynx of a greater or less degree results, but is of no consequence. The patients should be warned of this possible condition so that they may not be unduly frightened. Applications of nitrate of silver may be made daily until the symptoms begin to diminish, when the time can be lengthened between the applications. The voice should be given all the rest possible. Any possible source of irritation in the nose and throat should be removed. Cryptic tonsils, prominent or submerged, or tonsils showing evidence of interstitial irritation or chronic inflammation, should be removed by dissection.

The attention in the very beginning is directed to the correction of any constitutional dyscrasia. A change to a dry, warm climate may be necessary to induce a cure in obstinate cases. Rigid rules of personal hygiene should be enforced.

Hypertrophic Laryngitis.—Hypertophic laryngitis is a circumscribed or diffused hypertrophy of the vocal cords and mucosa, due to a chronic inflammation. The circumscribed form is subdivided into two classes, viz., singer's nodules and granular laryngitis.

The diffused form may be divided into two forms, viz., the superior or general, and the inferior, *i.e.*, situated beneath the vocal cords. The best example of the chronic, diffused form is pachyderma laryngitis, as described by Virchow.

Etiology and Cause.—Successive attacks of acute laryngitis are

the leading factor in the production of the disease, supplemented by continued injudicious use of the voice, unhygienic surroundings, tobacco and alcoholic excesses, gout, rheumatism and general debility.

Symptomatology.—The patient complains of continued hoarseness which is aggravated by any effort at phonation. The voice may be completely lost. There is a hacking cough with expectoration of thick, tenacious mucus, suggestive of approaching tuberculosis. The cough is very often aggravated by using the voice.

Diagnosis.—With a laryngoscopic mirror and under good illumination, the mucous membrane of the larynx may be seen to be very much thickened with circumscribed or diffused alterations in structure.

Singer's nodes, or "*chorditis tuberosa*" of Türck, are small, white, nodular eruptions, single or double, situated upon the anterior portion of the free border of the vocal cords. They are usually observed in singers, orators and actors, though many exceptions to the rule are noted.

The granular form is diagnosed by the pecular diffused, granulated appearance of the vocal cords in their anterior aspect. The granulations are much larger and more numerous than the nodular form, white in color and are surrounded by congested areas.

The diffused variety is recognized by the partial or complete, uneven swelling of the mucous membrane of the ventricular bands and cords. The overgrowth or hyperplastic condition observed at the posterior commissure, dark grayish and non-vascular in appearance, has been given the name of pachyderma laryngitis.

The same grayish overgrowth of tissue may sometimes be observed beneath the vocal cords, moving with them and described as *chronic laryngitis hypertrophica inferior.*

Course and Prognosis.—The progress of the disease is essentially very slow. As far as complete recovery of the voice is concerned, a guarded prognosis must be given. The greater the amount of hyperplastic change observable, the less possibility of complete recovery and in consequence, a return to the normal of the pitch and quality of the voice cannot be promised.

Treatment.—The predisposing factors of the disease, such as con-

stitutional dyscrasia, irritating habits, occupation and unhygienic surroundings, should receive immediate attention. Any gastro-intestinal or uric acid condition should be removed.

Attention is directed to the removal of any nasal obstruction, enlarged tonsils or bad teeth. Public speakers should be instructed how to modulate the voice so as to cause the least irritation.

The local treatment as in the acute form consists in first cleansing with some mild, alkaline solution, followed, if there is much secretion, by the direct application of some of the well-known astringents, such as nitrate of silver, ten grains to the ounce of water, chlorid of zinc, ten grains to the ounce of water, sulphate of zinc, ten to twenty grains to the ounce of water.

Where there is a lessened secretion and dry huskiness of the voice, the following stimulating solution may be applied once daily:

℞ Iodini,		2.00 gm. (gr. xxx)
Potas. iod.,		3.00 gm. (gr. xlv)
Glycerini, Aq. destill.,	āā	30.00 c.c. (℥ i)

M.
Signa.

Tobacco and the excessive use of alcohol are interdicted. A light wine at meal-time may be allowed to those accustomed to such indulgences.

For home use, the patient should be given ten grains of benzoate of soda, three times daily, to stimulate glandular elimination. The following may be prescribed to be used in an inhaler, for the patient to breathe deeply for one-half hour three times daily:

℞ Tinct. benzoin. comp.,	60.00 c.c. (℥ ii)
Ol. pini,	1.00 c.c. (gr. xv)
Menthol,	2.00 gm. (gr. xxx)
Camphoræ,	1.00 gm. (gr. xv)

Signa. Add one teaspoonful to one pint of boiling water and use as directed.

In the nodular and granular forms, complete rest of the voice, in addition to the general treatment as recommended above, will usually

relieve the condition. In a few cases where hypertrophies or nodules are somewhat pedunculated, laryngeal biting forceps may be used. Though surgical procedures of this character are only carried out with difficulty and hardly within the domain of the general practitioner, the same may be said of the galvano-cautery. Local applications of iodi-iodin solution as recommended above, with a cotton-tipped probe once daily, will usually prove very satisfactory.

Laryngitis Sicca.—Laryngitis sicca is a recognized atrophy of the laryngeal mucous membrane, characterized by the formation of crusts upon the surface.

Etiology.—The disease is usually an accompanying condition of fetid atrophic rhinitis and is a tropho-neurosis, probably resulting from an extension of the nasal trouble by continuity of tissue or absorption of toxins from the nasal suppuration.

Inherited dyscrasia, syphilis and tuberculosis probably play a very important part in predisposing the patient to the disease. The structures of the mucous membrane of the larynx differ slightly from that of the nose, which difference in the normal subject is antagonistic to the extension of inflammation from the nose and pharynx.

Age and sex have but little influence in the production of the disease. Personal habits which diminish *tissue de resistance* are predisposing factors in the causation of the disease.

Symptomatology.—The patient complains of a hoarseness with a dry, tickling sensation in the throat. The thick crusts and shreds which stick tenaciously to the surface of the larynx are often only expelled with great difficulty. Sometimes the mucus, which is subsequently expectorated, may be stained with blood.

The frequent presence of the thick mucus over the surface of the vocal cords produces a cough and dyspnea.

Prognosis.—The recovery of the disease is dependent upon the relief of the cause, which, as related, is more often a fetid atrophic rhinitis, and, this disease being an obstinate one, only temporary and palliative measures can be offered the patient.

Diagnosis.—In addition to the naso-pharyngeal irritation, which is usually present, a general appearance of dryness of the cords and mucosa is observed.

The cords and false cords will be seen to be covered with a tenacious, greenish-black secretion. At times, the cords may even appear narrowed. Frequent attacks of acute laryngitis, which cause the cords to become congested, may accompany the disease.

There is always a history of a long-continued irritation of the larynx.

Treatment.—The treatment is the same as that indicated for pharyngitis sicca (see Pharyngitis Sicca). Those remedies which tend to the promotion of glandular secretion should be administered, such as phosphorus, one one-hundredth grain doses, or iodid of potassium in three grain doses. Spraying the throat with Dobell's solution or inhaling steam from boiling water to which has been added one to three grains of carbolic acid (D. Braden Kyle), will aid in the removal of the secretion.

Frequently spraying the throat with the following will relieve the most distressing symptoms:

℞	Menthol,	.30 gm. (gr. v)
	Ol. pini,	.24 gm. (gr. iv)
	Albolene,	30.00 c.c. (℥ j)
M.		

One per cent. solution of chlorid of zinc applied direct will have a stimulating influence.

Membranous Laryngitis.—*Etiology.*—Membranous laryngitis or croup is more often observed in children than in adults. The predisposing causes of the disease are a lowering of the vitality of the parts from unhygienic surroundings, sudden climatic changes, exposure to cold, intestinal derangement, constitutional dyscrasia, inherited predisposition to the disease, enlarged tonsils, adenoids, chronic nasal catarrh, acute laryngitis, measles and scarlet fever.

The exciting cause is infection from the Klebs-Löffler bacillus, the staphylococcus or the diplococcus.

Pathology.—There is a rapid swelling of the mucous membrane of the larynx and the epithelium covering the vocal cords with a round cell infiltration, followed by fibrinous exudation which coagulates on the surface and forms a pseudo-membrane. The duality of the croup and diphtheria is contended by a number of authorities.

In true diphtheria there is a profound systemic intoxication from the toxins eliminated by the action of the Klebs-Löffler bacillus, whereas, in croup from infection with the streptococcus or diplococcus, there is an absence of severe systemic intoxication.

In the majority of cases, croup is diphtheritic in nature and due to the Klebs-Löffler bacillus.

Croupous inflammation is usually confined to the region above the vocal cords and may become descending in character, producing a tracheo-laryngitis. In young children and those suffering from pertussis, croup may have its origin in the trachea and ascend to the laryngeal mucosa.

Symptomatolgy.—The disease more often comes on during the night and is sometimes preceded by a cold in the head with slight fever and vomiting for a few days. The patient suddenly becomes hoarse, followed by a slight cough which is rapidly accentuated and becomes a barking or croupy cough. There is a rise of temperature, headache and redness of the face. With the increase of swelling and stenosis of the vocal cords, the patient gasps for breath and presents the picture of alarming cyanosis.

The paroxysms vary in intensity and may last for only a short time and recur in a few hours. The child may be quite free from the spasms during the day, only to have them repeated the following night.

Death may occur from exhaustion, heart failure or asphyxia. In favorable cases, the spasm gradually lessens in frequency or suddenly completely disappears. The child falls asleep from exhaustion and the recovery is uninterrupted.

Prognosis.—The disease is frequently fatal, the patient dying in collapse. The results of tracheotomy and intubation are more favorable in croup from infection with the streptococcus or diplococcus than in true diphtheritic infection.

Treatment.—The constitutional treatment consists in the administration of one to five thousand units of antitoxin which may be repeated in twenty-four hours if no marked amelioration of the symptoms is observed. One-tenth grain doses of calomel should be administered every hour until free purgation results. Emetics are rarely

necessary. Leeches are sometimes applied about the larynx as a quick antiphlogistic measure.

The local treatment consists in moist inhalation from a cresolin lamp or simplex inhaler. Cresolin may be used with the cresolin lamp or simplex inhaler. In the absence of cresolin, compound tincture of benzoin, one ounce, to which is added carbolic acid in a strength of five per cent., may be added. The throat should be frequently sprayed with acetozone and campho-menthol in albolene. Antiphlogistin as a poultice to the neck is highly efficacious. The child should be encouraged to freely drink hot milk or hot malted milk. The child should be isolated and kept in a room at a temperature of 75° F. The room should be carefully ventilated from time to time and the air of the room well moistened with steam of a boiling kettle. When stenosis of the larynx is very great, intubation should be performed early. The tube is generally worn from one to seven days, according to the severity of the disease (see Technique of Intubation).

Edema of the Larynx.—Edema of the larynx is an acute condition characterized by a serous exudation into the tissue above the vocal cords.

Etiology.—The causes of the disease are both local and general. The local causes are traumatism, heat, cold, applications of the cautery, gunshot wound in the neck, erysipelas, peritonsillar abscess, lingual abscess, syphilis, tuberculosis and malignant disease of the larynx and angina neurotic edema.

The general causes are a lowering of the vitality from climatic conditions, unhygienic surroundings, rheumatism, pulmonary tuberculosis, valvular heart disease and disease of the kidney.

Pathology.—The disease is probably some vaso-motor disturbance and is characterized by local or diffused serous exudation in the submucous tissue of the larynx.

Symptomatology.—The disease is sudden in its onset. The patient is attacked by dyspnea and difficult swallowing. There is a partial or complete loss of voice due either to edema of the ary-epiglottic folds, the mucous membrane covering the epiglottis, or the mucous membrane covering the true vocal cords, and in rare cases the sub-

glottic laryngeal mucous membrane. The location of the swelling necessarily varies according to the traumatism and *tissue de resistance.*

Diagnosis.—Upon examination with the laryngoscopic mirror and with the tongue protruding from the mouth, the edematous mucous membrane is easly detected. The general appearance of the larynx is the same as that observed in acute edema of the uvula. Difficult breathing is a prominent subjective symptom.

Treatment.—The constitutional treatment should be directed as far as possible to the relief of the general causes producing the disease. Free purgation is usually indicated at once. The patient should be confined to a warm room with the atmosphere moistened with steam from a boiling kettle. Hot applications to the throat externally and hot astringent gargles are indicated early in the disease. Where the edema is well developed, the bulbar mass should be punctured with a laryngeal cutting forceps under good illumination.

Pilocarpin in 1/12 to 1/20 grain doses, twice daily, will aid in stimulating the elimination and absorption of the edema. The prophylactic treatment is directed to the correction of any constitutional dyscrasia and the avoidance of any condition known to excite the disease.

Syphilis of the Larynx.—Syphilis of the larynx, as other than a factor in the etiology of chronic laryngitis, is frequently observed.

A Primary Lesion, from the anatomical position of the larynx, can hardly exist. Such a condition may possibly exist at times and is overlooked.

Secondary Lesions of syphilis are characterized by marked hyperemia and catarrhal inflammation of the larynx. Minute ulceration may sometimes occur. John N. Mackenzie mentions having observed one case of mucous patch of the larynx.

Tertiary Lesions of syphilis of the larynx are more often encountered and may be gummata, fibroid degeneration or ulceration. Tertiary lesions may extend to the trachea from the larynx. Lesions of this character may be confined to the trachea alone, or even the bronchi.

Symptomatology.—The symptoms of syphilis of the larynx vary in intensity, according to the progress of the disease. However, there

are usually sensations of fullness in the throat, catarrhal laryngitis and partial or complete aphonia. There is usually a history of syphilis and subjective symptoms of the disease.

Diagnosis.—A diagnosis of chronic hypertrophic laryngitis due to syphilis can only be positive after antisyphilitic treatment. In the early stages of tuberculosis and some forms of malignant and non-malignant tumors, the diagnosis can only be made after the administration of iodid of potassium.

In the early stages of gummata, the diseased area appears swollen and slightly red, surrounded sometimes by dilated blood vessels. The location of the gummata may be observed in any portion of the larynx.

As the name suggests, a fibroid degeneration appears as a hard and nodular tumor, which steadily encroaches on the lumen of the glottis, producing deformity. They have a whitish or anemic appearance and are hard to the touch.

In the ulcerative stage, the ulcers may be single or multiple and according to Mackenzie, more often appear on the lingual surface and free edge of the epiglottis. The vocal cords are less frequently involved than the upper part of the larynx. In the tertiary ulceration, there is deep destruction of tissue. The healing takes place from the periphery with the formation of anticicatricial scars and deformity in proportion to the amount of tissue destroyed.

The disease may be mistaken for tuberculosis or malignant neoplasms. Neoplasms and cicatricial bands from ulceration in the trachea and bronchi may lead to consolidation of one or both lungs, and the diagnosis of such a lesion can only be positive by bronchoscopy.

Prognosis.—Under active antisyphilitic treatment, the prognosis is usually favorable. Cicatricial bands may be formed, interfering with respiration, which demand subsequent removal with the laryngeal cutting forceps.

Treatment.—The general treatment varies in no wise from that of syphilis of the nose. The patient should be warned against the use of tobacco and alcoholic liquors. In paralysis of the larynx, in addition to the antisyphilitic treatment, electricity and strychnia by the mouth or hypodermatically, are indicated.

Cicatricial bands may be destroyed by the laryngeal cutting for-

ceps. In extensive stenosis, intubation or tracheotomy may be necessary to prevent suffocation. Cicatricial bands in the trachea or bronchi can sometimes be destroyed by passing a soft bougie through the Killian bronchoscope in situ, as suggested by Killian. In a slow consolidation of the lung, in a syphilitic patient, one should always keep in mind the possibility of a stricture as the exciting cause of the disease.

Dilation with Schrotter's dilators is sometimes valuable in stricture of the glottis. (See Treatment of Syphilis of the Nose).

Tuberculosis of the Larynx.—Tuberculosis of the larynx is a primary or secondary infection of the laryngeal mucous membrane and submucous structures, due to the tubercle bacilli.

Etiology.—The causes are both predisposing and exciting. The predisposing causes of the disease are chronic laryngitis, exposure to tubercle infection, tubercular diathesis, constitutional syphilis and primary tubercular involvement of the lungs. The disease is more often observed between the age of twenty and forty years.

According to Schmaus and Ewing, tuberculosis of the larynx and trachea occur in about thirty per cent. of the cases of phthisis and in the majority of cases follows infection by the bacilli in the sputum passing over the laryngeal surface. Geo. L. Richards believes that in ninety-five per cent. or more of the cases, the disease coexists with, or is secondary to, tuberculosis of the lungs.

Infection may also reach the larynx through the lymph channels, mouth of the glandular ducts or the blood supply from an infected lung.

Meyer, E. Fränkel and Jonathan Wright believe the bacillus can enter the structures of the larynx through intact epithelium.

From the foregoing the conclusion is that but few cases of primary infection of the larynx exists. Sidney Yankauer, in a review of the literature of the subject of tuberculosis of the larynx, reports the case of B. D. Sheedy, in which the larynx was involved for nine months and tubercle bacilli found, before the lungs became affected.

Pathology.—As in tuberculosis of other mucous membranes, there is a hyperemia and erosion of the surface of the epithelum followed by the formation of small tumefactions or nodules under the epithelium, surrounded by a mass of round cells with one or more giant cells.

The giant cells of the submiliary tubercle are characteristic in that their nuclei are situated within the periphery with their long diameters radiating from the center of the cell. The small nodules under the

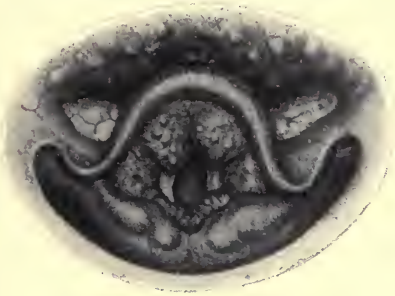

FIG. 153.—TUBERCULOSIS TUMORS. (After *Gruenwald.*)

epithelium extending to the surface undergo caseous or fatty degeneration, with the formation of an ulcer and destruction of cartilaginous structure. Before caseous degeneration takes place, the

FIG. 154.—TUBERCULOSIS OF THE LARYNX. (After *Schnitzler and Knight.*) Clubbing of the arytenoids and papillary excrescences at posterior commissure.

tumefaction in the glottis, aryglottic folds, epiglottis and arytenoids, may be seen.

The location of the tubercle is often in the arytenoid cartilages, ary-epiglottic fold or vocal cords. The true status of primary infection of the larynx is open to discussion.

J. W. Gleitman believes in the occasional occurrence of primary

tuberculosis of the larynx; Grayson, that the disease is extremely rare; J. Horne, that when the larynx is affected, there is an already affected area in the lungs.

Symptomatology.—The majority of cases of tuberculosis of the lungs is preceded by a chronic catarrhal laryngitis, which is primary or secondary to pulmonary tuberculosis.

The patient complains of a dry cough, hoarseness and a sensation of a lump in the throat, which may continue for a long time without any other symptoms other than chronic laryngitis.

The amount of sputum varies according to the lung involvement. As the swelling increases and ulceration takes place, the voice may become entirely lost and swallowing difficult and painful.

In the early stages of the disease, there is no external evidence of laryngeal irritation until swelling and ulceration of the larynx have taken place. Pressure upon the external wall produces pain and the parts are swollen and hard to the touch. In the beginning of the disease, there is a sensation of general malaise, loss of flesh and slight rise of temperature. As the disease progresses, night sweats and a general hectic condition supervenes.

In the early stage of the disease, the mucous membrane is found, upon inspection, to be pale and anemic in appearance. Small areas of red and thickened tissue will be seen within the field. Sometimes in the early stages of the disease, small, grayish, pin-point-like nodules may be seen beneath the epithelium before the swelling and infiltration have taken place. In the infiltration stage of the disease, a distinct tumefaction is observed in the epiglottis (turban-shaped epiglottis), arytenoids (club-shaped), one or both, or the ary-epiglottic fold. Later on, the edematous membrane becomes covered with grayish spots or miliary tubercles which are beneath the surface. The miliary tubercles soon break down and converge; thus distinct areas of ulceration are easily detected. The ulcer is grayish-yellow in color and is covered with mucus and pus. Paralysis of one or both cords may be present. In ulceration of the vocal cords, the "distinct notches" and "worm-eaten" appearance are detected.

Diagnosis.—The early diagnosis of the disease is sometimes difficult. With a dry, hacking cough, periodical attacks of hoarseness

and a tubercular history, the disease should be suspected. With the observation of the above enumeration of symptoms and discovery of the tubercle bacilli, diagnosis is usually certain.

The disease may resemble syphilis and possibly carcinoma. Syphilis will respond quickly to antisyphilitic treatment and carcinoma is characterized by great pain. Small tumefactions of the arytenoid cartilage on the posterior wall of the larynx, unilateral congestion of the vocal cords with hoarseness are early signs of the disease. For the early detection of the disease, Glietsman recommends Dr. Van Ruck's watery extract of tubercle bacilli. If there is no general reaction, there will be observed locally an increase of hyperemia and a visible increase in the size of the infiltration and nodules

For the early detection of pulmonary tuberculosis and before the bacillus is discovered, Remouchamps highly recommends a method of laryngeal crepitus. The patient sits erect with the mouth open, before the physician, whose right hand rests upon the patient's left shoulder and left thumb upon the patient's chin. With the physician's ear two or three inches from the patient's mouth, a small crepitation can be heard as though directed from the larynx. The sound is compared to that of a pin scratching the surface of fine paper. The sound is more distinct during expiration than in inspiration.

Prognosis.—Most pregnant women suffering from laryngeal tuberculosis "die during pregnancy or soon after." In larnygeal tuberculosis, provided the lung lesion is not too far advanced and can be cured or brought to a standstill by climatic conditions or local treatment, the prognosis is favorable in many cases.

S. E. Solly says of the cases treated in Colorado: "Taking the results in laryngeal cases without considering the ultimate fate of the patient, there was permanent arrest of the local disease in sixty-four per cent., temporary arrest in five per cent. additional cases in which latter the tissues again broke down shortly before death. Looking at the ulcerated cases alone, fifty per cent. healed permanently, ten per cent. temporarily."

Treatment.—The treatment is medical, surgical and radiotherapeutical.

The medical treatment is both general and local.

The general treatment is directed to securing the best hygienic surroundings and preferably in a high and dry altitude.

If such cases can be confined to a sanitarium for the cure of the disease in the early stages, prospects for the relief of all the symptoms and the arrest of the disease would be much more favorable than otherwise.

According to Solly (*Journal of Laryngology*, June, 1904), in cases of tubercle infiltration of the larynx without ulceration, the best treatment is by submucous injection of about twenty drops of a fifteen per cent. watery solution of lactic acid, preceded by the injection of cocain and adrenalin, the injection being somewhat painful, but not extremely so. Solly also recommends Lugol's solution with an equal solution of alcohol and glycerin painted lightly over the parts, two or three times weekly.

During the ulcerative stage of the disease and while the pain is quite severe, Solly recommends cocainization of the parts with a ten per cent. solution and touching with pure lactic acid, as recommended by Krause.

Gentle curettement followed by the application of fifty to thirty per cent. solution lactic acid is highly recommended by Heryng. For the relief of pain during ulceration, S. Solis Cohen recommends the following to be insufflated into the larynx:

℞	Orthoform, Anesthesin, āā	4.00 gm. (ʒ i)
	Ext. suprarenalin,	8.00 gm. (ʒ ii)
	Iodoformi, āā	8.00 gm. (ʒ ii)

Freudenthal recommends as a local anesthesia the following emulsion:

℞	Menthol,	.90 gm. (gr. xv)
	Ol. amygdal. dulc.,	15.00 c.c. (ʒ ss)
	Vitelli ovarim,	25.00 c.c. (ʒ vij)
	Orthoform,	12.50 gm. (ʒ iij)
	Aquæ destill., q. s. ad.	100.00 c.c. (ʒ iij)
Fiat.	Emulsionis.	

For the relief of cough, codein sulphate may be given in one-fourth grain doses and heroin in one-twelfth grain doses. During

the stage of infiltration, Gruenwald and Kronenberg report favorable results from the application of the galvano-cautery and insist that this form of treatment is far superior to chemic agencies. Lockard, of Denver, reports favorable results from the use of formalin in both the infiltrative and ulcerative stages of the disease. According to Lockard, after local anesthesia by the application of cocain, the parts should be sprayed with a one-half per cent. solution of formaldehyde after which the infiltrated and ulcerated surfaces should be scrubbed each day with a solution of three to ten per cent. solution of formaldehyde according to the susceptibility of the individual.

In addition, the patient is instructed to spray the throat frequently with a one-two-hundred-and-fiftieth solution of formalin.

The operative treatment for the cure of tuberculosis of the larynx is somewhat limited and is especially indicated in tuberculous tumors and deep ulcerations of the epiglottis. When pulmonic symptoms of the disease are well advanced, operative procedures are contraindicated. Where the pulmonic symptoms are very mild, operative procedures for the relief of stenosis and the removal of tubercular tumors may be advised.

The operative procedures recommended by Lockard are as follows:

1. Division of the posterior commissure in the median line, under cocain anesthesia, with a pair of angular scissors. Rectal feeding for one week, if necessary.

2. Division or removal of the epiglottis.

3. Tracheotomy.

4. Laryngo-fissure (for method see Laryngo-fissure in Carcinoma of the Larynx.)

Gruenwald reports satisfactory results in the nodular form of the disease by reflected sunlight. The rays of the sun are directed into the throat with an ordinary mirror and again reflected into the larynx by means of the laryngeal mirror.

With the X-ray, Finsen light, ultra-violet ray and actinic light, results are indefinite.

Epiglottitis.—Epiglottitis may be acute or chronic and is usually associated with a like condition of inflammation in the surrounding tissue.

Etiology.—The disease is more often due to traumatism or injury from thermic or chemic causes. Acute inflammation of the epiglottis may result from injury in the use of the galvano-cautery, in or about the larynx. The epiglottis is frequently involved in syphilis, tuberculosis, malignant and non-malignant growths.

Symptomatology and Diagnosis.—There is usually more or less distress upon swallowing and pain in the region of the epiglottis. Upon inspection, the epiglottis is usually seen to be hyperemic and the mucous membrane sometimes presents an appearance of general hypertrophy.

The diagnosis is usually established with the laryngoscopic mirror, under good illumination.

Treatment.—The local treatment is the same as that for acute or chronic laryngitis.

The general treatment is directed to the relief of the constitutional dyscrasia producing the disease.

Chondritis and Perichondritis.—Acute or chronic inflammation of the larynx is usually secondary to an inflammation of the mucous membrane.

Etiology.—The causes of chondritis or perichondritis are usually syphilis, tuberculosis, diphtheria, rheumatism, scarlet fever, typhoid fever, traumatism and exposure to cold. Infection from pathogenic organisms is usually a secondary condition and follows a lowering of the metabolism of the cartilage and its covering, by the above enumerated causes.

Symptomatology.—There is usually painful swallowing, rise of temperature and constipation, followed by swelling of the cartilaginous framework and hyperemia of the mucous membrane. The pain upon pressure over the larynx is usually very great. The pain in acute perichondritis is usually quite severe and is aggravated by eating, talking and drinking. Suppuration and destruction of cartilage may take place and are dependent upon the exciting cause of the disease.

In tertiary syphilis, tuberculosis and malignant tumors, there is usually more or less destruction of the chondrium.

Treatment.—The treatment varies somewhat according to the

etiology of the disease. Cold externally is indicated early in the disease by means of the Pressnitz bandage, ice bag or Leiter coil. This is continued for forty-eight hours, after which dry heat should be instituted. Calomel should be given in one-half grain doses at bed time, followed by a brisk saline cathartic in the morning.

If syphilis, tuberculosis or rheumatism are exciting causes of the disease, the constitutional treatment is as heretofore outlined.

The local treatment consists in spraying the throat with acetozone inhalent and frequently gargling with a warm, antiseptic and alkaline solution. Steam antiseptic inhalations are frequently very beneficial.

Fracture and Dislocation of the Larynx.—*Etiology.*—Fracture and dislocation of the larynx may result from a blow, hanging, gunshot wound and contusion.

Symptomatology.—The conspicuous symptoms are great pain and swelling of the larynx, crepitation, dyspnea, convulsive coughing, bloody expectoration and difficult swallowing. Speech is rendered very difficult or is entirely lost. Marked emphysema may follow rupture of the mucous membrane. Instantaneous death frequently follows dislocation.

Treatment.—The treatment is directed to the correction of the displacement by passing the finger into the pharynx and making contrapressure.

The subsequent treatment is directed to the reduction of the swelling by hot, moist applications, rest in bed, and rectal feeding for a short time. If there is increasing dyspnea, tracheotomy is indicated. Hemorrhage from the mucous membrane may be controlled by touching the bleeding surface with sponges which have been moistened in a hot solution of adrenalin chlorid, 1/5,000.

Non-malignant Neoplasms of the Larynx.—Non-malignant tumors of the larynx, as in any other portion of the body, have no tendency to spread by metastasis and do not recur after complete removal. They are dangerous to life only in that they interfere with deglutition, respiration, and predispose the patient to constitutional diseases.

Benign neoplasms in the order of their frequency are papilloma, fibroma, cystoma, myxoma, enchondroma, lipoma and adenoma.

Etiology.—The causes of non-malignant neoplasms are more often faulty metabolism from constitutional diseases, prolonged irritation of the larynx from excessive use of the voice, chronic inflammation, tobacco and alcoholic excesses. The affection is more often observed in men in adult life.

Pathology.—(See Pathology of Benign Tumors.)

Symptomatology.—The usual symptoms are hoarseness, sensation of a foreign body in the larynx and symptoms of a chronic catarrhal inflammation. The voice may become entirely lost, or may have a peculiar sound as of a foreign body in the back of the throat. In exercise, stooping and certain occupations, the victim of a neoplasm

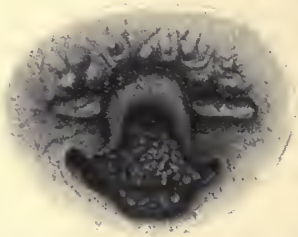

FIG. 155.—PAPILLOMA OF THE LARYNX. (After *Gruenwald*.)

in the larynx may suffer from dyspnea and difficult swallowing. In advanced cases, the tumor may suddenly completely close the larynx and produce asphyxiation.

PAPILLOMATA are more often observed in young adults. The tumors take their origin from the papillæ of the mucosa and may be single or multiple in number. The tumors are granulated or wart-like in appearance, of a pale pink color and are more often situated on the vocal bands (Fig. 155).

The condition may be mistaken for tuberculosis or syphilis of the larynx.

FIBROMATA are connective-tissue tumor growths, presenting a smooth reddened surface. The tumors vary in size and usually possess a broad base.

CYSTOMATA may occur at any age and are usually pedun-

culated and may be intrinsic or extrinsic. The pedicle of the extrinsic cystomata is sometimes very difficult to locate. The tumors appear dark bluish in color and perfectly symmetrical. Large tumors of this character are usually extrinsic. During examination, a large tumor of this character may deceive the examiner as to its exact origin.

ANGIOMATA may be sessile or pedunculated. The deep bluish discoloration and tendency to bleed will enable one to diagnose the condition.

MYXOMATA usually occur on the vocal bands and may be pedunculated or sessile. The diagnosis is usually by removal of a small portion of the growth and microscopical examination.

ENCHONDROMATA, or cartilaginous tumors, occur in some portion of the cartilage of the larynx. They are usually hard to the touch and extremely slow in growth.

LIPOMATA are usually pedunculated tumors and in the case of Holts, described by Knight, the tumor was pedunculated, having its origin on the rim of the glottis.

ADENOMATA are tumors originating in dilated glands. According to Grayson, the location is more often in the epiglottis. Generally speaking, non-malignant tumors are slow in their growth and can be differentiated from tuberculosis, syphilis and malignant diseases by these symptoms: absence of ulceration and systemic disturbances.

Treatment.—Broadly speaking, the treatment of non-malignant neoplasms is surgical and consists in their removal, *per viæ naturales*, thyrotomy, tracheotomy and intubation.

Non-malignant growths of the larynx may be destroyed with the galvano-cautery or chemical caustics. One objectionable feature in regard to the use of the cautery in the larynx is the tendency to acute edema. For the removal of papilloma, the Chiari cutting forceps (Fig. 156), Mackenzie forceps for evulsion and Schrotter-Türck cannula forceps are indicated. The operation may be performed under twenty per cent. solution of cocain anesthesia. Kirstein's autoscope may sometimes be advantageously used for the removal of neoplasms. General anesthesia is usually indicated in children. The anesthesia should not be produced to a point of complete narcosis.

Cystomata of the larynx may sometimes be removed with the snare or twisted from their pedicles.

Fibromata which cannot be easily removed through the natural channel, should be removed by laryngotomy and the same rule is applicable to enchondromata, and angiomata. On account of the tendency to severe hemorrhage in the removal of the angiomata, the external operation is usually preferable.

The after-treatment consists in cleansing the nose and throat with

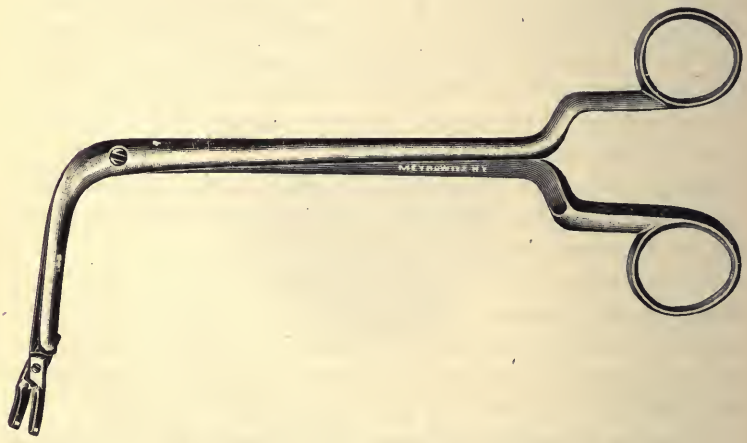

FIG. 156.—CHIARI'S LARYNGEAL FORCEPS.

Dobell's solution, followed by an oil spray consisting of aristol, acetozone, camphor and menthol (see formula, p. 132).

Malignant Neoplasms of the Larynx.—Malignant neoplasms of the larynx are carcinoma and sarcoma, which are classified by Krishaber as intrinsic and extrinsic.

According to De Santi, intrinsic tumors are those which arise in connection with the vocal cords, ventricles and false vocal cords, or may be immediately below the true vocal cords. The term, extrinsic, may be applied to tumors which grow from the epiglottis, ary-epiglottic folds and intra-arytenoid folds, etc.

According to Krishaber, lymphatics are not involved as long as

the tumor is intrinsc, but as soon as the tumor becomes extrinsic, the lymphatics are quickly affected.

Etiology.—The etiology of malignant growths of the larynx is still a matter of conjecture. The predisposing causes are syphilis, chronic ulceration, age, heredity and prolonged irritation of the larynx from systemic disturbances, tobacco and alcoholic liquor.

Carcinoma is much more frequent than sarcoma. Out of one hundred and three cases of malignant disease of the larynx, Semon found three cases of sarcoma. Sarcoma, as in other portons of the body, occurs at an earlier age than carcinoma. According to statistics, carcinoma is more frequently observed between the ages of fifty and sixty and sarcoma between the ages of forty and fifty.

Pathology.—(See Pathology of Malignant Growths.) The most frequent form of carcinoma of the larynx is the "epitheliomatous variety." The other varieties are exceedingly rare. "Spindle cell sarcoma is more frequently observed than any other form."

Symptomatology.—The first symptom of intrinsic carcinoma is hoarseness, followed by pain. Hoarseness is likewise a preliminary symptom in sarcoma. The hoarseness in sarcoma is usually due to pressure, whereas, in carcinoma, the condition is more often due to direct involvement of the true and false vocal cords. The pain in carcinoma is more intense than that of sarcoma. In both conditions, there is a sensation of fullness in the throat and as the growth increases in size, there is a dysphagia and stenosis of the glottis causing dyspnea. The pain of extrinsic carcinoma is greater than that of intrinsic.

De Santi says that in some cases of intrinsic carcinoma, no pain is experienced during the whole course of the disease. The pain is aggravated in all forms of malignant growths of the larynx, by swallowing and speaking. Pain radiating to the ear is a suggestive sign of malignant tumor of the larynx.

Diagnosis.—On account of its insidious nature, a malignant tumor is usually far advanced before the physician is consulted, and in consequence, a distinct pathological change is early detected by laryngoscopical examination.

Upon laryngoscopic examination in carcinoma of the larynx there may be detected a crater-like ulceration, a papillomatous or wart-like

excrescence, a thick and circumscribed reddish discoloration or a distinct, irregular tumor springing from some portion of the larynx, more often on one of the vocal cords.

In the early stages of epithelioma of the vocal cords, the cord is observed to be red and swollen with a tendency to increase in size, followed by ulceration and complete destruction.

A more or less distinct tumor is observed in sarcoma of the larynx. Ulceration in sarcoma is not so manifest as in carcinoma. A smooth, irregular tumor, somewhat pale in color, may lead to the first suspection of sarcoma.

Both sarcoma and carcinoma may resemble a non-malignant tumor, syphilitic ulceration, syphilitic gummata, tubercular infiltration or perichondritis.

A small section of the growth should be removed in all cases of suspected neoplasm of the larynx and subjected to a careful microscopical examination, for only by this method can the character of the tumor be differentiated and active measures instituted for its cure. In addition to the microscopical examination of the secretion of the tumor removed, John N. Mackenzie advocates laryngotomy for diagnostic purposes. F. Semon maintains that, if the vocal cord from which a suspected laryngeal growth springs shows at an early period of the disease a defect of mobility other than due to mechanical impaction of the growth in the glottis on phonation, this sign is almost pathognomonic for the malignant character of the tumor.

Prognosis.—In uncomplicated malignant growths of intrinsic origin in which surgical measures are early instituted and the growth entirely removed, the prognosis is favorable. In involvement of the lymphatics, the prognosis is unfavorable. In malignant, extrinsic tumors of the larynx, on account of the blood and lymph supply, there is a great tendency to metastasis.

Treatment.—The treatment of both sarcoma and carcinoma is more especially operative. Iodid of potassium should be pushed to the limit for diagnostic purposes in all suspected cases of tumor of the larynx. The steady progress of the disease and the diagnosis of malignant neoplasms make palliative treatment a waste of time, and radical operative measures imperative.

Dr. Ernesto Botella, of Madrid, in the consideration of the actual status of the different methods employed in the treatment of cancer of the larynx, gives the following report of results: Endo-laryngeal operations, 5.7 per cent. resulted in death from the operation; 22.8 per cent. in recurrences; 28.5 per cent. cures. Laryngotomy gave 7.5 per cent. deaths from the operation; 41.5 per cent. recurrences; 26.4 per cent. cures; total extirpation, 34 per cent. deaths from operation; 23.3 per cent. recurrences; 9 per cent. cures. Hemilaryngectomy gave 25 per cent. deaths from operation; 26.7 per cent. recurrences; 14 per cent. cures.

Since the death of Frederick the Noble, interlaryngeal operations for the removal of malignant growths have been entirely supplemented by the operation of thyrotomy.

Laryngectomy is the complete removal of the larynx, the technique of which can be had from any text-book on general surgery (Jacobson and Steward, Vol. II).

The operation of thyrotomy is as follows:

The patient is placed upon the operating table in a prone position and anesthetized with chloroform. Under rigid antiseptic precautions and with the neck elevated, the incision is made through the skin from the hyoid bone in a median line down to near the sternum. The structures are separated down to the thyroid cartilage or trachea with scissors and blunt end of a scalpel. The blood vessels are clamped and the edges of the wound separated with a retractor. After the insertion of the cannula, the blood vessels should be ligated. The trachea is now opened as for low tracheotomy and a "Hahn's compressed sponge cannula inserted" (De Santi). "The operator now waits for a period of ten to twelve minutes, until the sponge swells" from the absorption of the moisture and completely closes the trachea. Beginning at the cricoid cartilage, the thyroid cartilage is split in the median line, care being taken not to injure the attachment of the epiglottis. Where the cartilage has undergone calcification, a strong pair of scissors or saw will be necessary to split the cartilage.

In the method of Butlin, the thyroid cartilages are now separated and held apart by a silk thread passed through the cartilage. "The

parts are anesthetized with a twenty per cent. solution of cocain" to prevent spasm of the larynx. Under good illumination from a Killian lamp or head-mirror, the larynx is explored and the tumor outlined. The growth should be completely removed at least one-half inch into the normal tissue, with a knife or scissors, preferably the scissors. After the spouting blood vessels are ligated and the wound thoroughly dried, the thyroid cartilages are again brought together and fixed in position with silk or silver sutures. The Hahn tube is now removed, and, according to De Santi, the edges of the cutaneous wound are brought together and sutured, except at the lower part, where the tube is inserted. This is left open to enable blood and secretion to escape from the larynx and the subcutaneous tissues. The wound is covered with iodoform gauze, which should be frequently changed. The tendency to constipation should be relieved with enema. Feeding is usually through a tube or per rectum, for a few days. It is sometimes possible for the patient to take liquid food or water with the head turned far over to the opposite side from that operated upon. As soon as the patient can do this successfully, all liquid foods can be taken in this manner through a tube placed in the angle of the mouth.

The local treatment consists in cleansing the throat and region of the larynx with a cotton-tipped probe dipped in Dobell's solution, after which the wound is dusted with iodoform or aristol. Exuberant granulations appearing during the process of healing may be destroyed by touching with a strong solution of nitrate of silver.

As a substitute for dry insufflation, the following may be used in a spray, three times daily:

℞	Olive oil,	60.00 c.c. (fl. ℥ ii)
	Aristol,	12.00 gm. (grs. cc)
	Dissolve and add	
	Acetoform,	.60 gm. (gr. x)
	Camphor,	1.20 gm. (gr. xx)
	Menthol,	1.20 gm. (gr. xx)
	Eucalyptol,	.72 c.c. (min. xii)
	Albolene,	60.00 c.c. (fl. ℥ ii)
Dissolve.		
Signa.		

CHAPTER XXXII.

DISEASES OF THE LARYNX (CONTINUED).—NEUROSIS OF THE LARYNX.

NEUROSIS of the larynx is an incoördination of motion, due to some trophic disturbance and is subdivided into two classes, *i. e.*, motion and sensation. Neurosis of motion is subdivided into spasms of the laryngeal muscles, laryngismus stridulus, aphonia spastica, laryngeal chorea and laryngeal epilepsy and paralysis.

Neurosis of sensation may be anesthesia, hyperesthesia and paresthesia.

Laryngismus Stridulus.—Laryngismus stridulus or spasm of the glottis is a spasmodic condition of the adductors of the vocal cords and is more often observed in young children.

Etiology.—The disease may be due to some nervous derangement, rachitis as observed of Kassowitz, exposure to cold, a predisposition to the disease, adenoids or enlarged tonsils.

Symptomatology.—The attack comes on suddenly during the night without the prodromal symptoms of cold and inflammation as observed in croup. The spasm may be repeated during the day. The parent is usually awakened by the dry, crowing-like sounds made by the child in an effort at inspiration. The child is observed to be tossing about the bed from the agony and distress from difficult breathing. At the height of the spasm and marked cyanosis, the symptoms suddenly pass away as the child takes a deep inspiration, without leaving any inflammatory symptoms.

Diagnosis.—The disease differs from croup in that there is no exudation, swelling of the mucous membrane or inflammatory symptoms.

Prognosis.—There is a tendency for the attack to recur at intervals for a period of a week to a number of months. Death seldom occurs

from the disease. In very young children, the disease sometimes terminates in general eclampsia or convulsions (Gratzer).

Treatment.—The treatment is directed to the relief of the spasm produced by an adduction of the vocal cords and consists in the external application to the larynx and neck of extreme cold or heat.

Three drops of 1/1,000 solution of adrenalin chlorid, hypodermatically, will sometimes relieve the spasm.

Other methods for the relief of the spasm are splashing cold water in the face, patting the child on the back, forcible extension of the tongue and sneezing produced by the bearded end of a quill passed into the nose, as recommended by Gratzer.

Prophylactic treatment consists in the administration of somnos in from one-half to one teaspoonful doses, given four times daily, or the following:

℞	Tinct. belladonnæ,	.74 (gtt. xij)
	Chloralis hydratis,	1.25 (gtt. xx)
	Potassii bromidi,	3.90 (ʒ j)
	Syr. pruni vir.,	15.00 (ʒ ss)
	Aq. men. pip.,	90.00 (ʒ iij)

Signa. Teaspoonful every hour until relief from the spasm is produced.

Prophylactic treatment is directed to the removal of adenoids or enlarged tonsils that may be present and the correction of any constitutional dyscrasia.

Congenital Laryngeal and Tracheal Stridor.—This is presumably a congenital deformity of the upper laryngeal structures, due to faulty coördinated type of respiration, occurring in infants and disappearing about the second year of life.

Etiology.—The etiology, according to A. Logan Turner (*Journal of Laryngology, Rhinology and Otology*, Vol. XXI, No. 10) is as follows:

"Various explanations have been offered to account for these clinical phenomena: thus we have a reflex laryngeal irritation induced by the presence of adenoids in the naso-pharynx (Robertson, Eustace Smith); pressure upon the trachea from an enlarged thymus (Avellis, Hochsinger); congenital malformation of the upper aperture of the

larynx (Lees, Sutherland and Lack, Refslund, Variot, Koplik); an ill-coördinated spasmodic action of the respiratory muscles inducing an exaggeration of the normal infantile type of larynx, an acquired deformity (Thompson and Logan Turner)."

Symptomatology.—Shortly after birth, the child is noticed to be suffering from noisy breathing. The noise is croaking in character accompanying inspiration and is sometimes high pitched in forced inspiration. In expiration, there may be a short croak, as described by Turner. The stridors will not always continue and will vary in intensity according to the physical condition of the patient, exposure to cold air, crying, cold in the head, and are more constant in the waking hours of child, than when it is sleeping. There is usually no distress in breathing and no evidence of cyanosis. There is, in severe cases, recurrent indrawing of the thoracic and abdominal walls.

The symptoms increase during the first few months, remaining stationary after a few months and gradually lessening during the first two years of life.

Pathology.—The exact pathology of the disease is somewhat conjectural. Turner believes the disease to be an acquired deformity of the upper laryngeal aperture, due to an ill-coördinated type of respiration.

Both Thompson and Logan have carried on post-mortem examinations and also findings of the larynx in still-born infants and children up to ten years of life. They describe the structures of the larynx, that is, the epiglottis, the tip of the arytenoid cartilage, the interarytenoid fold behind, the ary-epiglottic folds laterally, as being soft and more collapsible than in the adult. They also discovered that the aperture of the larynx of the still-born infant is relatively wider than that of the infant which had breathed. As the child advances in years, the conditions which alter the shape of the larynx gradually disappear and the structure assumes the normal shape, that is, the epiglottis becomes broader and, according to the authorities quoted above, the infantile type of larynx almost entirely disappears at the nineth year of life.

In some cases reported, there was enlargement of the thymus and thyroid glands which made pressure upon the trachea. In the

case of hypertrophied thymus and thyroid, Avellis and Hochsinger advanced the theory that the approximation of the ary-epiglottic fold is due to the deep lying stenosis and that the approximation of the laryngeal structures resembles that observed in the alæ-nasi as they are tucked in as a result of obstructed nasal and post-nasal breathing. Adenoid vegetation, hypertrophied tonsils, congenital tumors of the larynx and inflammatory conditions of the larynx and trachea are frequently found present and are evident pathological conditions contributing directly to this peculiar stridor.

Diagnosis.—The diagnosis depends upon the symptoms enumerated above, that is the peculiar crowing or croaking sound accompanying inspiration, sometimes high pitched, or "child crowing," or "inspiratory standstill" without marked cyanosis and with only slight distress in breathing.

The disease is present at birth and is continuous with slight accentuations from exposure to cold air and crying, and disappears about the second year of life.

The disease should not be confounded with spasmodic croup, laryngismus stridulus, diphtheria, or spasmodic closure of the epiglottis.

Course and Prognosis.—The disease usually runs its course about the second year of life, ending in complete recovery.

The prognosis of the condition depends somewhat upon the exciting causes of the disease. The condition, however, has a tendency to run an uninterrupted course, ending in complete recovery.

Treatment.—The treatment is necessarily somewhat subjective and should be directed to the correction of any nasal deformity, removal of adenoids and enlarged tonsils, relief of gastro-intestinal disorders and constitutional dyscrasias and the relief of any inflammation or hypertrophy of the mucous membrane of the larynx. If the epiglottis should become lax, it may be lifted into position with a blunt hook. The nutrition of the parts may be stimulated by external massage or the application of the galvanic cautery, negative pole to the larynx and positive pole to the nape of the neck. In laryngeal irritation, the mucous membrane hypertrophy may be somewhat contradicted by steam inhalations of compound tincture of benzoin in

water or iodin in water, (see page 132). Constitutional dyscrasias may be corrected by tonics and alteratives. The neck and chest should be sponged once daily with very cold water, followed by drying with a coarse towel.

Aphonia Spastic or Spasm of the Tensor of the Vocal Cord.—This is a condition in which the cords are, as described by Gowers, brought together too forcibly.

The patient cannot speak at all, or the voice is found altered and disappears after a few efforts at phonation. The condition may come on suddenly in the middle of a sentence and the speaker may be compelled to desist from further effort. The patient may suffer pain in the larynx (Jurasz-Gravers). There is no observable alteration in the vocal cords.

The treatment is directed to rest of the voice, tonics, personal hygiene and out-door exercise.

Hysterical Aphonia.—Hysterical aphonia, sometimes called functional aphonia or hysterical mutism, is a partial or complete loss of the voice, due to a peculiar psychical incoördination, induced by some local or central disturbance, producing a partial or complete incoördination of muscular movements and sometimes loss of sensation in the larynx.

Etiology and Pathology.—It is sometimes very difficult to arrive at the exact cause of this peculiar perversion of the function of speech. The same cause that produces a perversion of function in any other portion of the body may be said to produce the disease.

The disease is more frequently found in women than in men, and more often between the ages of twenty and thirty years.

Among the important causes are heredity, *i. e.* those with an inherited neurotic diathesis, surroundings and neurotic associates, emotional excitement, sudden alarm, especially in children, uterine disorders, sexual excesses, laryngeal catarrh, adenoids and enlarged tonsils, epilepsy, scarlet fever, mumps, measles, and disturbances of the speech centers.

The pathological changes seen in the brain at post mortem vary according to the associated diseases. In the absence of associated diseases, there will be no observable pathological changes in the speech

centers. There may be some functional or anatomical derangement in the center of speech or afferent or efferent nerve structures, belonging to the pneumogastric or spinal accessory nerves. Pathological changes in the larynx may be those observed in trophic disturbances or the opposite, according to the character of the hysteria.

Symptomatology.—The character of the local expression may vary according to the structural perversion. The symptoms may be divided into convulsive and non-convulsive forms. The convulsive form is best expressed by the term, laryngeal spasm. In this form, there is intense respiratory stridor without loss of voice, due to a bilateral paralysis of the abductors. According to Gowers, this condition is rare. The usual form is non-convulsive, and is more often partial paralysis of the adductors. The patient's voice is partially or completely lost, and if the hypoglossal is also perverted, whispered speech is also lost.

The vocal cords may approximate in coughing, but not in speech. In one case observed by the author, the vocal cords would seemingly approximate with the patient's effort to phonate, yet no sound would be emitted, not even whispered speech. As a rule, the patient's voice is temporarily lost and suddenly returns, only to be lost or changed in tone by some excitement. In hysterical aphonia, due to adduction paralysis, the patient may have a loud cough, but in the true adduction paralysis, cough cannot be produced. (Phonetic Paralysis of Türck.)

Other motor paralysis may be present, such as hemiplegia, paraplegia, loss of sensation, and hysterical ataxy.

The two forms of the disease may be persistent or paroxysmal, and continue from a few minutes, to years, with intervals of relief.

Diagnosis.—The disease should not be confounded with true paralysis of the laryngeal muscles, aphonia from tumors, or hemorrhagic extravasation in the brain, or other causes, such as inflammatory conditions of the larynx, aneurism of the aorta, traumatism, tumors, injury to the recurrent laryngeal nerve, syphilis, and functional disturbances, due to multiple sclerosis and tabes. Adhesions in the lenticular zone will produce a condition clinically known as anarthria

which is characterized by a loss of the power of speech, with complete comprehension of words and writing.

The variability of the pitch of the voice, periodical loss of voice, dry cough and absence of any associated disease, with history suggestive of hysteria, all point to the peculiarity of the disease.

In suit for damage for alleged loss of voice from traumatism, the correct diagnosis of hysterical aphonia, is of great importance. In such cases, a general anesthetic, pushed to the stage of excitement, may sometimes disclose the nature of the vocal lesion.

Prognosis.—The prognosis is very uncertain, and complete recovery of the voice may never occur. The patient is prone to suffer from recurrent attacks of the disease.

Treatment.—The local treatment is directed to the removal of any hypertrophy in the post-nasal space and diseased tonsils. Any catarrhal condition of the larynx should be treated with tonics and mild astringents applied direct to the mucous membrane with a cotton-tipped probe or spray. Vibratory massage should be applied to the larynx once daily. In the absence of this form of electricity, the faradic current, externally, to the larynx, is highly recommended. The extralaryngeal application of electricity is probably as efficient as the intralaryngeal application.

The patient's generally impaired nervous system should be corrected by out-door exercise and tonics, especially iron, quinin and strychnia. Sometimes the voice, or power of vocal coördination, may be controlled by directing the patient in the correct enunciation of the different vowels, after filling the lungs with air. Breathing exercises are to be highly commended. This form of exercise should be repeated daily for a short time, followed by complete rest of the voice.

Laryngeal Chorea.—Laryngeal chorea is a condition of lack of coördination of the glottis, characterized by a persistent, dry, barking cough, which may continue during the day or only at longer or shorter intervals. There is no hoarseness or perceptible change in the quality of the voice. The condition occurs more frequently in hysterical females. Upon examination with the laryngoscope, the cords can be detected, during the beginning of the spasm, to suddenly

close with great force. The cords are again quickly and suddenly separated by an expiratory effort, which produces the characteristic barking cough.

Treatment.—The treatment is directed to the building up of the system with tonics of strychnin, iron, quinin and zinc phosphid.

The negative pole of the galvanic current may be applied once daily over the larynx and the positive to the nape of the neck.

Laryngeal Vertigo.—Laryngeal vertigo is a peculiar incoördination of movement of the vocal cords, producing closure of the glottis, followed by dizziness and loss of consciousness. The attack is ushered in by a sudden irritation in the larynx and is followed by vertigo and unconsciousness lasting for a few seconds. The attacks may come on at different intervals and continue over a number of months.

Treatment.—The treatment is directed to the building up of the general health, personal hygiene and out-door exercise.

If due to pressure, operative measures should be instituted. Strychnia, 1/15 gr., subcutaneously once daily, with the positive pole of the galvanic current over the course of the nerve is indicated in adults.

Paralysis of the Crico-thyroid.—There is an unevenness of one or both vocal cords which is due to inability of the muscle to tilt or lower the posterior part of the arytenoid cartilage and bring the cords tense.

The cause of the disease is injury or disease of the superior laryngeal nerve and is more often due to the toxins of diphtheria.

Symptomatology.—The symptoms are hoarseness, pain upon prolonged use of the voice and, as described by Cohen, a lack of precision in phonation, a peculiar dissonant slide occasionally occurring during conversation.

Treatment.—The treatment is directed to the removal of the cause and if due to diphtheritic toxins, iodid of potassium in small doses and strychnia, one-sixtieth to one-fifteenth of a grain, three times daily, are indicated.

Paralysis of the Thyro-arytenoid Muscle.—There is a partial loss of the voice due to the inability of the vocal cords to approximate when one or both muscles are paralyzed (Fig. 157). The edges of

the cords are concave. The inner fibers, or internal tensor, are more often affected.

The cause is acute or chronic laryngitis, syphilis, tuberculosis, injudicious use of the voice, neoplasms which have affected the nerve by pressure, diphtheria or hysteria. The voice may be partially or completely lost.

Treatment.—The treatment is rest of the voice, strychnia internally and the correction of any constitutional dyscrasia.

Paralysis of the Lateral Crico-arytenoid Muscle (Bilateral or Unilateral Adductor Paralysis).—In paralysis of the lateral crico-

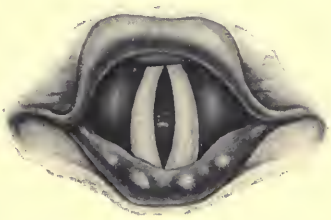

FIG. 157.—BILATERAL PARALYSIS OF THE INTERNAL THYRO-ARYTENOIDS. (After *Knight.*)

arytenoid muscle, one or both cords being affected, they are widely separated at their base.

This condition is rarely met and is due to hysteria and pelvic disorders in women. There is a sudden loss of function and complete aphonia.

Treatment.—The treatment is directed to the restoration of the weakened nervous system and the correction of any pelvic disorders. Static electricity, or iron and strychnia, are usually highly beneficial.

Paralysis of the Arytenoideus.—In paralysis of the arytenoideus there is an inability to approximate the arytenoid cartilages and posterior ends of the vocal cords (Fig. 158).

The cause of the condition is traumatism, syphilis, local or general tuberculosis, acute pharyngitis, ulceration, tumors between the cartilages and hysteria.

There is a hoarseness and fatigue of the voice upon efforts at

phonation. Upon examination, the triangle formed by the vocal cords at the arytenoid attachment is easily discernible and diagnosed.

Treatment.—The treatment is directed to the removal of the cause. Tonics and galvanism are usually indicated.

Complete Paralysis.—*Etiology.*—The cause may be organic disease of the brain, the neoplasm pressing upon the laryngeal nerve or the pneumogastric nerve after its exit from the brain, aneurism of the right subclavian or innominate artery, aneurism of the arch of the aorta, locomotor paralysis and paralysis of the insane, syphilis,

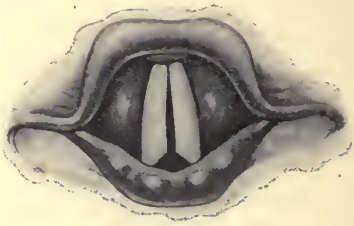

FIG. 158.—PARALYSIS OF THE ARYTENOIDEUS. (After *Knight.*)

injury and degeneration of the nerve trunk. The voice may be impaired, but not lost, in either unilateral or bilateral paralysis.

Complete paralysis of the recurrent laryngeal nerve may be detected, upon laryngoscopic examination, by the complete immobility of the vocal cord at a position relatively midway between the position of phonation and deep inspiration.

In unilateral paralysis, the unaffected cord may be observed approximating the middle line and sometimes crossing the middle line, the unaffected arytenoid passing in front of the paralyzed. There is little loss of voice though dysphonia exists (Cohen).

In bilateral paralysis there is a slight dyspnea and nearly complete aphonia (Fig. 157).

The cause may be aneurism of the arch of aorta and enlarged glands of the neck, typhoid fever and diphtheria.

Paralysis of the right side may be due to aneurism of innominata or subclavian artery and pleuritic adhesion at the apex of the lungs.

The central cause may be cerebral apoplexy, cerebral tumors, cerebral abscess, embolism and syphilitic degeneration.

The paralysis is governed by the cause and duration of the condition. If the condition has existed for some time and the nerve cells have undergone degenerative change, the prognosis is unfavorable. If due to local irritation and the cause is amenable to treatment, the prognosis is favorable. If the central lesion is due to syphilis, results may be favorable under antisyphilitic treatment.

Treatment.—The local and general treatment is subjective and is

FIG. 159.—COMPLETE RIGHT RECURRENT PARALYSIS ON PHONATION. (After *Knight.*)

directed to the removal of the cause. Surgical treatment of cancer of the esophagus or tumor of the neck, pressing upon the nerve, is early indicated.

Galvanism is indicated with the negative pole applied with the Mackenzie laryngeal electrode along the course of the nerve, the positive pole to the nape of the neck. Strychnia should be given internally in one-sixtieth to one-twentieth grain, three times daily or one-fiftieth grain to one-twentieth hypodermatically.

Anesthesia of the Larynx.—Anesthesia of the larynx may be partial or complete and is a loss of sensation in the mucous membrane, sometimes extending to the epiglottis and trachea.

Etiology.—This condition may result from disease of the superior laryngeal nerve, the roots of the vagus and degeneration in the medulla (Gowers). The condition may result from the absorption of the toxins of diphtheria, tuberculosis and pathogenic bacteria. The affection is sometimes observed as an accompanying condition of ulceration of the larynx, hysteria and chronic laryngitis.

Symptomatology and Diagnosis.—With a loss of sensation, there is an absence of the faculty of reflex expulsion, and, in consequence, foreign bodies may be sucked into the larynx and trachea producing asphyxiation, septic pneumonia and sometimes death.

Treatment.—In diseases of the medulla, destruction of the root of

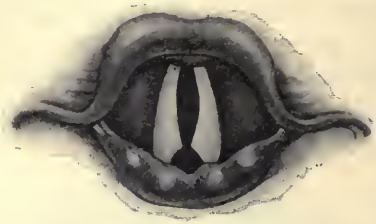

FIG. 160.—PARALYSIS OF THE INTERNAL THYRO-ARTYENOIDS AND OF ARYTENOIDEUS. (After *Knight.*)

the vagus or the superior, recurrent laryngeal nerve from ulceration, local or general treatment will have no effect. As a sequela to diphtheria, or general infection, alteratives, tonics and faradism with the negative pole to the larynx, results are favorable.

Chronic catarrhal affections of the larynx should be treated as described under that affection (see Chronic Laryngitis).

Hyperesthesia of the Larynx.—Hyperesthesia of the larynx is a condition of hypersensitiveness of the laryngeal mucous membrane.

Etiology.—Many individuals of a nervous temperament suffer from a hyperesthesia of the larynx. Among the causes which may be classed as both predisposing and exciting are tuberculosis of the lungs, syphilis, alcoholism, hysteria, acute or chronic catarrhal inflammation, sometimes morbid growths of the larynx, rheumatism, gastro-intestinal disorders, adenoids, enlarged tonsils, pelvic diseases in women and irritation at the base of the tongue.

Symptomatology and Diagnosis.—There is usually an annoying laryngeal cough, expectoration of mucus and at times hoarseness. Pain and inflammation may be due to the catarrhal cough and effort to dislodge minute accumulations of mucus. The larynx may be unduly sensitive to irritating gases, atmospheric changes, etc.

Treatment.—The constitutional treatment is subjective and is directed to the relief of any of the above enumerated contributing factors of the disease.

The local treatment is directed to the relief of any local irritation by the application of a solution of nitrate of silver, two to ten grains to the ounce. A Pressnitz bandage can be worn advantageously for one-half hour daily. Cold plunge baths or cold sponging of the neck and chest are especially efficacious in the absence of the cold full bath.

Paresthesia of the Larynx.—Paresthesia is a perverted or abnormally sensitive condition of the laryngeal mucous membrane.

Etiology.—The condition is more frequently associated with hysteria, insanity and highly nervous individuals, who may have injured the epithelium by some foreign body passing into the esophagus. The condition may be due to a chronic irritation of contiguous parts.

Symptomatology and Diagnosis.—The patient frequently complains of the presence of a foreign body in the larynx and a smarting and burning sensation. The patient may give a history of having swallowed some foreign substance, which seems to them to have lodged in the larynx, preventing free phonation and irritation. Upon inspection little or no irritation of the larynx can be detected.

Treatment.—The treatment is directed to building up the patient's general health and alleviation of the nervous condition by the administration of hyoscyamus, nux vomica, phosphate of zinc and quinin. The patient should be convinced by the physician of the complete absence of any foreign substance, and for this, a thorough exploration with the X-ray and laryngoscopic mirror should be made. In addition to the above methods of exploration, the Kirstein autoscope may be used. External vibratory massage to the larynx is sometimes highly beneficial. This should be applied once daily for a period of from ten to fifteen minutes.

CHAPTER XXXIII.

DISEASES OF THE TRACHEA AND BRONCHI.

Tracheo-bronchitis.—Tracheo-bronchitis is either an acute or chronic inflammation of the mucosa of the trachea, usually involving the laryngeal mucous membrane and extending to the bronchi. The chronic form of the disease will be considered under chronic bronchitis.

Etiology.—The causes of the acute form are both predisposing and exciting. Among the predisposing causes are an acute catarrhal condition of the upper air passages, tubercular diathesis, chronic bronchitis, chronic naso-pharyngeal catarrh, cryptic tonsils, decayed teeth, inhalation of noxious gases and vegetable dusts, nasal stenosis, damp and disagreeable atmospheric conditions, measles, scarlet fever, diphtheria, typhoid fever, and small-pox.

The disease is more often observed in children and people of advanced age than in individuals of middle age, and is more prevalent in early spring and autumn.

The disease is probably infectious and is often observed in camps and large settlements. Explorers in the far north seldom or never suffer from acute inflammatory diseases of the upper air passages.

The exciting cause is a lowering of the vitality from "catching cold" and infection with some pathogenic organism. (See Bacteriology of the Trachea.) Microörganisms are probably carried to the mucosa through forced or normally inspired air, or the blood and lymph channels.

Infection in the nose and throat may spread to the tracheal mucosa by continuity of tissue, or by process of inspiration. The last method probably holds true in naso-pharyngeal catarrh and inflammatory diseases of the sinus, where the patient, in order to clear the nose and pharynx, sucks the secretion back in the throat by forced inspiration.

In the greater number of acute cases of this character, the expulsive power of the ciliated epithelium and the tissue resistance are sufficient to prevent infection.

Pathology.—In the beginning of the infection, the pathology varies but little from that of inflammation of any other mucous membrane. The larynx is usually more or less inflamed, and in many respects the tracheal affection is the counterpart of acute catarrhal laryngitis, with the exception that the swelling, hyperemia and impaired function have extended to the first few rings of the trachea, and, in consequence, the symptoms are more pronounced than in simple laryngitis.

Sputum is absent or only very slight, and, when present, is almost pure mucin, sometimes containing ciliated epithelial cells, leucocytes and red blood cells. After twenty-eight or thirty-six hours, the secretion becomes muco-purulent in character, containing pus cells, broken-down epithelium, leucocytes, and red blood cells. The sputum is thick and yellowish, sometimes mass-like, and oftentimes filled with dust and smoke products, when it becomes greenish or greenish-black in color. The discharge gradually thins and disappears in from a week to ten days.

Symptomatology.—In addition to the hoarseness and dryness of the larynx in severe cases, in children there may be difficulty in breathing from edema of the tracheal mucosa. There is usually, in the beginning of the disease, a sensation of dryness in the trachea, some tenderness upon pressure, pain and tenderness in the muscles of the neck, and dry hacking cough, accompanied by a smarting and burning sensation.

The secretion is a thin mucus at first, rapidly changing to muco-pus, and is more abundant in the morning, upon arising. The secretion is often tenacious and is only dislodged after vigorous coughing. Thick bands of mucus may adhere to the vocal cords, adding to the laryngeal irritation and hacking cough. The dry form of the disease may run its entire course with little or no secretion. Constipation is usually present with slight malaise.

Diagnosis.—In addition to the symptoms enumerated above, by laryngeal examination, with the patient in an erect position, with

the head bent slightly forward and body elevated above the examiner, so that while looking into the laryngeal mirror the angle of reflection is most acute, a good view of the trachea is obtained, sometimes down to the bifurcation.

The mucosa is of a deep pink or purplish hue, and in the second, or exudative stage of the disease, islands of mucous exudation may be seen.

The disease may extend and involve the larger bronchi.

Auscultation in simple catarrh of the trachea or larger bronchi shows nothing abnormal. In the exudative form, with narrowing of the bronchi from swelling or exudation, a variety of auscultatory sounds may be detected, as distinct or indistinct moist rales. In the dry form with slight stenosis, a shrill whistling or sibilant ronchi may be heard.

The condition should not be confounded with croup, laryngismus stridulus, angioneurotic edema, and a variety of skin eruptions, which have been noted in the trachea, as pemphigus, herpes, impetigo herpetiformus, and lichen ruber.

In acute tracheitis of small-pox, the characteristic vesicle seen on the surface can frequently be detected in the trachea.

In young children, the exudation from the trachea is not expectorated, but swallowed, predisposing to gastro-intestinal disorders, diarrhea, or constipation, especially the latter. Young children should be confined to bed or a warm room according to the severity of the affection. As a rule, the temperature in young children is much higher than in adults, varying from 100° to 103°.

Treatment.—The treatment varies but little from that recommended for acute laryngitis. Inhalations of steam from a simplex inhaler, impregnated with the following medication, are efficacious:

℞	Iodin,	.60 gm. (gr. x)
	Camphor,	
	Menthol, āā	1.80 gm. (ʒ ½)
	Ol. Gaultheriæ,	1.80 c.c. (gtt. xxx)
	Tr. Benzoin,	60.00 c.c. (ʒ ii)

Add one teaspoonful to a small pledget of cotton or wool in inhaler and use every three hours, for ten to fifteen minutes.

For the relief of the pain in the muscles of the neck, and edema of the tracheal mucosa, dry heat, or very hot glycerin and clay poultice should be applied to the neck.

For the distressing cough and difficult expectoration, one drachm of elixir of terpen hydrate et heroin should be given to adults every three hours, and in proportionate doses to children.

Free purgation should be secured early in the disease by the administration of calomel and soda at bed time, followed by a saline cathartic upon arising.

Chronic Bronchitis or Chronic Tracheo-bronchitis.—Chronic bronchitis or chronic tracheo-bronchitis is a chronic inflammation of the tracheal and bronchial mucosa, and may be due to recurrent attacks of acute catarrhal inflammation, or to some specific pathogenic organism.

Etiology.—Among the predisposing factors of the disease are recurrent attacks of acute tracheitis or bronchitis, catarrhal diathesis, bronchial asthma, hypertrophy of the thymus or thyroid gland, aneurism of the ascending aorta, pulmonary tuberculosis, valvular disease or myocarditis producing a stasis in the pulmonary circulation, inhalation of irritating gases, malformation of the upper air passages which interferes with normal breathing, chronic naso-pharyngeal catarrh, and chronic purulent inflammation of the sinuses. In chronic purulent discharge from the nose or accessory cavities, there is a constant tendency to hawk the secretion back into the throat by forced inspiration, and by so doing, particles of secretion and micro-örganisms may be sucked into the trachea.

The disease is usually observed in adults and old people, and more often in men than in women.

The exact role of pathogenic organisms in the etiology of chronic bronchitis, is uncertain. Their presence, whether primary or secondary, predispose to a greater chronicity of the disease, and frequently, under favorable conditions, its extension to the lung, ending in pneumonia or phthisis pulmonalis.

Pathology.—There is an irregular or diffuse thickening of the mucous membrane of the trachea, sometimes varicosities, and in the chronic suppurative form, destruction of the ciliated epithelium,

with the formation of flat cells. As a result of atrophy, bronchiectasis may occur. Ulcers of the mucosa may occur from infection, and trophic disturbances, predisposing to the formation of deep scars and cicatricial bands. The character of the secretion varies with the form of the disease, and may be the dry form of Laennec, or the moist.

In the moist form, the secretion may be composed of pus corpuscles, blood cells, broken-down pavement epithelium, and fat acid needles with microörganisms.

Among the organisms frequently found in the expectoration are the streptococcus, staphylococcus, pneumococcus, and the bacillus of influenza. The different forms of the disease, recognized from pathological conditions, are catarrhal, asthmatic, dry, putrid, and plastic bronchitis.

The last form may be acute or chronic and is characterized by the expectoration of casts of the bronchi, fibrous in character, containing broken-down epithelium, bacteria, leucocytes and red blood cells.

Symptomatology.—The two most important symptoms are cough and expectoration, which are more intense in the morning upon arising. The spasm of coughing may, however, be brought on by any one of many causes, such as inhalation of cold air, tobacco smoke, hot drinks, etc. The expectoration is often fluid-like, filled with whitish or yellowish masses, which, when allowed to stand, drop to the bottom of the test glass. Sometimes the expectoration is thick, slug-like, and discolored by inhaled smoke or dust.

It may be interesting to note the great variety of bacteria which are found in the expectoration from tracheal disease in contrast to that from a tuberculous lung, or any disease of the upper air passages. The finding of enormous bacterial flora in sputum from the respiratory tract is significant of bronchial disease, especially bronchial tuberculosis in contradistinction to pulmonary tuberculosis. Disease of the trachea and bronchi always shows greater bacterial invasion than similar disease of the lower respiratory organs or lungs.

The asthmatic form of the disease resembles the ordinary bronchial asthma, with the addition of cough and history of bronchitis.

The dry form of the disease was first described by Laennec, and

is characterized by a dry cough, practically free from any expectoration.

The putrid form of the disease is, as the name implies, characterized by profuse expectoration, offensive in character. The breath of the patient is extremely offensive, and the sputum, when allowed to stand for any length of time, is likewise putrid and nauseating. This condition is infrequently observed in private practice; however, in homes for the aged and hospitals for disabled soldiers, the disease is frequently seen.

In uncomplicated, chronic bronchitis, there is usually no elevation of temperature.

Diagnosis.—The disease should not be confounded with pulmonary tuberculosis, syphilis of the trachea, cough from reflex causes, or pressure upon the trachea from extrinsic hypertrophies or tumors. Cigarette smokers frequently suffer from a chronic morning cough.

The physical signs are absent. Upon auscultation, dry or moist rales, variable in pitch, are usually discovered.

Prognosis.—The disease has little or no tendency to spontaneous recovery, and unless the cause can be discovered and suitable treatment instituted, prognosis must be guarded.

Treatment.—The treatment is both general and local. The general treatment is directed to securing the best hygienic surroundings possible, with fresh air and plenty of sunshine. The climate of Colorado or New Mexico is suitable for many of these cases. San Remo, the Riviera, Egypt, and the Madeira Islands are highly recommended as winter resorts for those who can take advantage of a change of climate during the winter months.

The local treatment consists in relief of the cough, expectoration and absorption of bacterial products. For the control of the cough in the dry form of the disease, the following prescription is recommended:

℞ Potass. Iodide,	1.50 gm.	(gr. xxiv)
F. E. Grindaliæ robusta,	4. c.c.	(ʒ i)
Elix. terpen hydrate et heroin,	30. c.c.	(ʒ i)

M.

Signa. One teaspoonful four times daily, last dose at bed time.

In the moist form of the disease, chlorid of ammonium, in conjunction with the above, is usually efficacious. As an inhalent in the moist form of the disease with bacterial infection, nothing has given the author so much satisfaction as acetozone in liquid albolene (see page 132). Inhalation of the nascent chlorid of ammonium is highly recommended by many authorities.

In the dry form of the disease, a steam inhalation with the following solution is very efficacious:

℞ Sodii chlor.,	8.	gm. (ʒ ii)
F. E. Sanguinariæ,	4.	c.c. (ʒ i)
Phenol,	1.20	gm. (gtt. xx)
Glycerini,	4.	c.c. (ʒ i)
Aq. distillate, q. s. ad.	30.	c.c. (ʒ i)

M.

Signa. Add one teaspoonful to one-half pint of boiling water, and use three or four times daily.

For the relief of constipation and regulation of the bowels, phenolphthalein in from one to five grain doses should be taken at bed time.

For the relief of pain in the chest and dyspnea, counterirritation to the chest is indicated

Cold tub bath or cold neck bath upon arising is especially indicated as a stimulant to the throat and neck, and as a preventive against recurrent attacks of acute inflammation.

Perichondritis.—Perichondritis is an acute or chronic inflammation of the mucous membrane and cartilaginous rings.

Etiology.—The disease is usually produced by syphilis, traumatism or some general disease. Infection with some pathogenic organism is usually secondary, and results from the lowering of the vitality of the parts. The condition may be secondary to typhoid fever, small-pox, diphtheria, tuberculosis and syphilis. The cartilage may become eroded and necrotic from tracheotomy or violent injury from blow upon the neck or a fall, in which the rings are injured.

Pathology.—Following traumatism or some exhausting general disease, infection occurs with the formation of a slough in the cartilage, which may allow particles of the cartilage to be expectorated. The disease, however, may be only an inflammation without slough,

and a condition of ecchondrosis or the formation of ledges of cartilage covered with mucous membrane takes place. New formation of cartilage, internally, may tend to narrowing of the trachea or bronchi, producing a certain amount of dyspnea.

Treatment.—The treatment is directed to the reduction of any inflammation with hot applications, externally applied, rest of the voice, and building up the general economy with tonics and alteratives.

The nose and throat should be frequently irrigated with some alkaline and antiseptic solution to prevent new infection entering the trachea. Acetozone or steam inhalent with iodid, phenol and menthol in solution should be prescribed three or four times daily.

In the absence of a steam inhaler, the following may be used in an atomizer:

℞	Iodin,	1.20 gm. (gr. xx)
	Camphor,	
	Menthol, āā	3.60 gm. (ʒ i)
	Ol. gaultherii,	.72 c.c. (gtt. xii)
	Liquid albolene,	30. c.c. (ʒ i)

Signa. To be inhaled deeply into the trachea four or five times daily.

Tumors of the Trachea.—Since the investigation of Türck, in 1861, many intrinsic tumors of the trachea have been reported. With the invention of the bronchoscope, tumors of this character will have a wider recognition.

Tumors of the trachea may be either benign or malignant. Extrinsic tumors may be sarcomata, chondromata, gummata, cystomata, adenomata, fibromata, papillomata and angiomata, which may so press upon the trachea or glottis as to produce dyspnea and cyanosis.

Among the non-malignant tumors observed in the trachea are polypi, papillomata, enchondromata, chondromata, adenomata, chondro-osteomata, and lipomata. (See Theisen, *Annals of Otology, Rhinology and Laryngology*, December, 1906.) The character of the tumor cannot always be diagnosed while in loco.

Dyspnea in advanced cases makes a surgical procedure imperative, regardless of the supposed character of the growth.

Two forms of malignant growths have been observed in the trachea, carcinomata and sarcomata.

Symptomatology.—Non-malignant neoplasms usually produce little or no pain. The greatest immediate danger is the possibility of sudden edema and cyanosis. The greater the obstruction, the more manifest becomes the dyspnea.

Pedunculated tumors, with their base on the lateral pharyngeal wall or the larynx, may drop into the larynx, causing cyanosis. A pedunculated tumor, with its base attached to the inferior border of the vocal cords or crichoid cartilage, may be seen to move during expiration or coughing. Auscultation may show the pressure of a pedunculated tumor.

In intrinsic tumors, we may have bloody expectoration and dyspnea. In carcinomata there may be pain, dyspnea and bloody expectoration with general debility. Sarcomatous growths are usually slow, and may occur early in life. Pain is usually present. These tumors usually have a broad base and have little tendency to ulceration. The disease may occur early in life.

Diagnosis.—The diagnosis of external tumors may be by palpation, "X-ray," or sometimes by the bronchoscope. Tumors posterior to the trachea or laterally deep seated, pressing so as to narrow the lumen of the trachea, may be located by the tracheoscope or bronchoscope.

A chronic dry cough should always suggest a possibility of pressure upon the trachea by some abnormal swelling. In a great number of cases, intra-tracheal tumors can be detected with the laryngoscope. The patient should sit upright with the head bent slightly forward and above the examiner. In such a position, a more direct view of the trachea is obtained than in ordinary laryngoscopy.

Treatment.—The treatment is usually surgical. Sarcomata may grow so slowly that immediate operative measures are contraindicated. Neoplasms situated high up in the trachea have been known to slowly disappear following the prolonged use of a tracheotomy tube.

Small pedunculated tumors may sometimes be removed by the natural channel with the aid of Killian's tube or Kirstein's autoscope

and an intra-tracheal biting forcep. It is often advisable to split the thyroid cartilages, crichoid and first few rings of the trachea, to give free access to the growth. A low tracheotomy is necessary in such cases to prevent blood and debris reaching the lungs.

It is a very good rule not to attempt the removal of a suspected malignant tumor other than by the tracheo fissure, on account of the tendency to a more rapid growth from incomplete removal or irritation. In non-malignant tumors, there is not the general disposition to redevelopment if a portion of the tumor remains.

Pedunculated tumors, extrinsic or in the region of the larynx, can sometimes be removed by way of the natural channel, with a small biting forcep or long, curved scissors.

The general rule for the removal of external tumors is too well known to justify repetition. Injury to the superior and inferior laryngeal and facial nerves, and the carotids and laryngeal vein, should be carefully guarded against.

Syphilis of the Trachea and Bronchi.—Syphilis of the trachea and bronchi is more often tertiary than otherwise. However, an acute bronchitis has been observed following the initial exanthem, which disappeared with the instigation of treatment.

The trachea is probably more often involved in syphilis than we are at first led to suppose. Many times the symptoms are so light that we pass them by.

In the secondary stage of the disease, when all the mucous membrane, especially of the fauces, is usually involved, the mucosa of the trachea and bronchi not unlikely shares in the disease. The form of the disease which probably first manifests itself is an acute or chronic catarrhal condition, characterized by a hyperemia, cough and exudation, and may occur at any stage of the disease. Erythematous eruption in the trachea may occur as a result of similarity of structure between the skin and the mucous membrane, with the eruption on the surface. The irritation and symptoms from an erythematous eruption resemble the symptoms of acute bronchitis. Gummata may occur in the trachea, bronchi or lung and may be congenital or acquired. Gummata may undergo fatty degeneration, ulceration, and formation of cicatricial bands, and stenosis.

Structural change in the lung, as a result of the narrowing of the lumen of the trachea or bronchi, if not overcome by treatment, will ultimately end in solidification and collapse of the lung.

The diagnosis of respiratory obstruction may be made by auscultation and bronchoscopy. The character of the lesion, however, will be shown by its reaction to antisyphilitic treatment. Cicatricial bands can only be removed by the aid of a flexible, hard-rubber bougie or cutting forceps under good illumination, passed through the Killian bronchoscope. The author has observed this form of treatment at Professor Killian's clinics at Freiberg. In dilatation of stricture of the bronchi, the larynx is anesthetized with a twenty per cent. solution of cocain, in the adult; in children a general anesthetic is administered.

With the patient sitting on a low stool, head thrown far back, after anesthesia of the larynx is secured, with the operator standing in front of the patient, a long, cotton-tipped probe, saturated with a twenty per cent. solution of cocain, is passed directly into the trachea and down to the bifurcation. A second application can be made in a few minutes, passing the probe into the right and left bronchi. In passing the probe or bronchoscope into the right or left bronchus, the head should be turned to the opposite side.

With the bronchoscope in position, flexible rubber sounds are passed down to, and through, or by, the stricture. Professor Killian sometimes passes two or three sounds at one sitting, each one larger than the preceding one. The last sound is sometimes allowed to remain for as long as an hour and a half. While passing the cotton-tipped probe and sound, there is usually a great deal of mucus to contend with, and some retching. In the hand of Professor Killian, the operation is simple enough.

In the early diagnosis of syphilis of the trachea, there is usually a history of the disease, and not infrequently some local disturbance in the larynx, ulcers in the larynx and trachea, seen by the laryngoscope as grayish and indurated and surrounded by a bright red field.

In contrast to this, tuberculous ulcers are usually surrounded by a pale field. In addition, Professor Schrötter calls attention to the yellowish dots, which are infiltrated glands, in the field surrounding

a tuberculous ulcer, which condition is never observed in syphilitic ulcer.

Carcinomata may resemble a syphilitic ulcer or broken-down gummata, and only by relief secured by antisyphilitic treatment or section of the growth secured by aid of Kirstein's autoscope or Killian's bronchoscope, can we differentiate the disease.

Chondylomata of the trachea are overgrowths of the epithelium and appear as reddish or whitish projections on the surface, sometimes ulcerating. Such a condition is probably due to the presence of bacteria in the trachea or inhalation of irritating dusts. The disease does not respond to antisyphilitic treatment and is slow in its activity.

The rules for general treatment are the same as those for treatment of syphilis in any other part of the body. A very good rule to follow in bronchial or pulmonary cases, unattended with fever and in the absence of tubercle bacilli in the sputum and any indication of the possibility of syphilis, is to prescribe iodids, with some form of mercury.

Tuberculosis of the Trachea.—*Etiology.*—In a consideration of this subject, the author is indebted to an excellent review of the subject by James E. Newcomb (*Annals of Otology, Rhinology and Laryngology*, December, 1906).

Tracheal tuberculosis may be local, but, as a rule, is a part of a general pulmonary tuberculosis, resembling thus the laryngeal type of the disease. Infection of the glandular structures may occur from the presence of the bacilli within the lung, and is probably due to the continued passage of the tubercle bacilli over the surface of the trachea.

Newcomb (ibid) reports the case of Housemann, who found at autopsy on a woman, seventy-three years of age, a tuberculous disease of the trachea extending from the bronchi to the larynx. In this case, there was found no tuberculous infiltrations in any other portion of the body.

Other authorities were referred to by Newcomb, especially Jonathan Wright and J. N. Mackenzie, who clearly demonstrated the possibility of primary and limiting tuberculosis of the trachea.

Cornet (*Nothnagel's Practice*, 1905) cites the case of Valette, of primary tracheal tuberculosis, due to infection through the air.

The general anatomical arrangement of the tracheal moving ciliated epithelium, and the natural abhorrence of the tracheal mucosa for foreign substance, predispose to prevent infection.

The condition is to be expected in the old and ill-nourished individuals, in poor, unhygienic surroundings, who are suffering from chronic bronchitis. In the latter condition, the ciliated epithelium is very inactive and even destroyed, predisposing to local infection.

Diagnosis.—The diagnosis of tuberculosis of the trachea, from the nature of the disease, will be exceedingly difficult early in the disease before the nodular masses have broken down and the bacilli are mixed with the exudation. The mucosa of the trachea, through the laryngoscope or bronchoscope, should appear paler than usual, with tumor formations or ulcerations on the surface. With the discovery of miliary tubercles, the diagnosis is complete. The disease resembles syphilis and probably can only be differentiated from it by the absence of the tubercle bacilli or reaction to the iodid of potassium. Koch's tuberculin may be given for diagnostic purposes.

Treatment.—The treatment is directed to securing good hygienic surroundings and out-door exercise. Inhalations of steam impregnated with one of the formulæ indicated on page 132 are especially indicated.

Those versed in bronchoscopy may remove tubercular masses by the natural channel with one of the biting forceps so cleverly designed by Jackson, of Pittsburg.

The general rules for treatment are the same as those suggested in chronic bronchitis.

Tracheal Hemorrhage.—*Etiology.*—Hemorrhage from the trachea is not infrequently an accompanying condition of acute tracheitis, chronic bronchitis, ulceration or carcinomatous growths. The condition has been observed following or accompanying an attack of influenza and probably belongs to that peculiar type of influenza known as the hemorrhagic form; a similar type of influenza is noted in meningitis hemorrhagica and otitis media hemorrhagica. In

the last form of the disease, hemorrhagic bullæ may spring from the membrana tympani or bony portion of the auditory canal.

In other cases, the condition more often results from varicosities, which, not infrequently, can be detected with the aid of the laryngoscope. From coughing or irritation the varicosities may rupture and a few drops of blood or two or three ounces may be expelled. Hemorrhage may occur only one time or at frequent intervals.

Diagnosis.—The diagnosis of tracheal hemorrhage is by a process of exclusion. Hemorrhage may be from the post-nasal space, pharynx, or larynx, and simulate a tracheal hemorrhage. Hemoptysis may be due to hyperemia or ulcerations from pulmonary tuberculosis. Hemorrhage from a congested bronchial tube may be the first symptom of a beginning pulmonary tuberculosis. Lung involvement may be subsequently detected if not observed synchronous with the hemoptysis. A tracheal hemorrhage is usually accompanied by cough, peculiar filling sensation in the larynx, with welling up of blood in the throat. There are, in most cases, shock and nervous symptoms, more from the sight than loss of blood. In the young, the blood may be swallowed and then vomited.

Treatment.—Rest, and hypodermic injection of morphia et atropia, with cold compresses externally are first indicated, followed by free purgation. If due to congestion from influenza, the condition may be expected to go on to spontaneous recovery. In varicosities, in hemophilia, or arteriosclerosis, recurrence may be looked for. Varicosities that may be seen with the naked eye should, after anesthetizing the larynx and trachea with a twenty per cent. solution of cocain, be touched with a saturated solution of potassium permanganate. In those cases suspected of a beginning pulmonary tuberculosis, rest, nutritive diet, with out-door life are indicated.

Systemic or organic disorders which predispose to the hemorrhage, as emphysema, arteriosclerosis, sclerosis of the liver, ulcers of the trachea, or papillomatous growths should, as far as possible, be removed.

Foreign Bodies in the Trachea and Bronchus.—Among the many foreign bodies which are sucked into the trachea and bronchus

are pins, small toys, shelled peanuts and carpet nails. The right bronchus is more frequently affected on account of its more direct branching from the trachea.

Diagnosis.—There is usually more or less laryngeal spasm, cough and dyspnea accompanying the introduction of a foreign body into the trachea or bronchus. The patient may become cyanotic and die in a short time. By auscultation, one may sometimes detect the presence of a foreign body by friction caused by the movement of the body during inspiration and expiration and by the altered respiration in one or both lungs. With the radioscope or by radiography, metallic foreign bodies can be located. The size of the body governs to a great extent the respiratory movements of the lung, which can be detected upon auscultation.

Prognosis.—Broncho-pneumonia, abscess, hemorrhage, tuberculosis or gangrene may follow lodgment of foreign bodies in the bronchus. Unless the foreign body is quickly removed or expelled, a guarded prognosis should be given. Foreign bodies have been known to remain in the bronchus for years and after disintegrating and loosening, be coughed out.

Successive accumulations of pus may take place which will be expelled from time to time during a spasm of coughing.

Traumatic pneumonia is frequently one of the accompanying symptoms. Long pins which may have found lodgment are sometimes partially expelled in the act of coughing and can be seen with the eye. They remain in view for only a short time, when they are again sucked into the trachea, and expelled later.

Children are more prone to meet with this accident than adults. The trite saying that while there is life there is hope, is quite true of foreign bodies in the trachea and bronchus. Nature, in the moment of our despair, may loosen and expel the foreign body with the consequent restoration of the child to health.

Medical literature is replete with instances of foreign bodies in the lungs being coughed out after years.

Treatment.—The larynx should be carefully searched for the presence of a foreign body in a suspected case. In cases in which the examination is painful or difficult on account of the spasm of the

pharynx and larynx, the parts should be anesthetized with a four to ten per cent. solution of cocain, applied with a sponge or cotton-tipped probe. The larynx may be examined with the laryngoscope or Kirstein's autoscope in adults. According to Chevalier Jackson, chloroform anesthesia makes laryngoscopy quite easy in infants. Foreign bodies may sometimes be located with the X-ray.

Explorative thyrotomy or tracheotomy is indicated in cases where there is great difficulty in the examination of the larynx (see Thyrotomy and Tracheotomy). On account of the danger and difficulty of thyrotomy in young children, tracheotomy is the more frequent operation.

The foreign body may be expelled by the spasm of coughing following tracheotomy. With a curved hook or forcep, the foreign substance may sometimes be extracted. If this is accomplished by thyrotomy, or splitting the two lateral halves of the cartilage, they should be closed with a cat-gut suture.

In tracheotomy, the wound should be covered with bichlorid gauze and allowed to heal by granulation. If the foreign body cannot be removed following the tracheotomy on account of the spasm of the larynx, a tube should be inserted.

On removal of the tube for cleansing, or effort to dispense with it, a spasm of the larynx frequently occurs, demanding the quick reinsertion of the tube. The tube should not be allowed to remain in the trachea any longer than absolutely necessary.

For the extraction of steel or partially steel foreign bodies after tracheotomy, the Habb giant magnet may be used, as suggested by Dr. de Roaldes.

Tracheotomy.—Tracheotomy may be indicated in the following cases: croup, diphtheria, foreign bodies in the larynx or lower air passages, malignant or benign growths of the larynx, edema of the larynx, fracture of the larynx, syphilitic and tubercular ulceration and spasmodic closure of the larynx.

The successful termination of the operation depends to a great extent upon the disease and the early realization of the indications for its performance. If performed for the relief of membranous laryngitis in children under two years of age, the case usually ter-

minates fatally. If the dyspnea is very great and venous congestion and edema of the lungs in consequence have been allowed to become profound, accompanied with a rapidly failing heart, tracheotomy will, as a rule, only hasten death.

Site of Operation.—Two distinct regions for performing the operation have given rise to the descriptive terms, *high* and *low* operation.

The high operation consists in opening the trachea above the

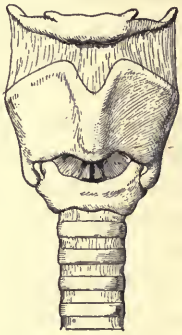

FIG. 161.—LARYNGOTOMY IN THE ADULT. (After *Veau.*)

Vertical incision through crico-thyroid membrane. At its lower end a cross incision divides the attachment of crico-thyroid ligaments.

thyroid isthmus between the thyroid and cricoid cartilage, including in many cases the cricoid cartilage and first ring of the trachea.

The low operation consists in opening the trachea below the isthmus, and, on account of the greater room for exploration and the prospect of larger opening into the trachea, is more often indicated.

The severe venous hemorrhage which often complicates the operation may be due to a plexus of veins covering the anterior surface. Small adventitious arteries may also cover the anterior surface and cause considerable hemorrhage upon severance.

Method of Operation.—The head and neck are stretched over a small pillow so as to bring the trachea prominently into view. The instruments necessary are a small scalpel, blunt dissector, dissecting forceps, artery clamps, director, silk gut ligature, tube and head-mirror. Chloroform is usually indicated for narcosis.

With the left hand of the operator steadying the trachea, an incision sufficiently large is made through the skin and superficial fascia. Bleeding points should be at once secured. With a blunt retractor, the rings of the cartilage, if in the low operation, or the cricoid cartilage, if in the high, are exposed. The white rings should be brought distinctly into view before making puncture with the knife. The incision of the cartilage should be in the median line.

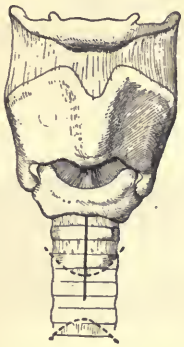

FIG. 162.—INCISION FOR TRACHEOTOMY ABOVE THE ISTHMUS, IN THE INFANT. (After *Veau.*)

Between the dotted lines lies the isthmus of the thyroid.

With the severance of the cartilaginous ring, a distinct blowing and whistling sound is produced. Previous to the insertion of the cannula, the wound should be cleansed of all mucus, blood or other debris, after which the cannula is inserted and held in position by ribbon tape around the neck.

It is well to remember that as soon as the ring of the trachea is severed, blood, if present, will be sucked into the trachea upon inhalation and will be thrown out through the wound in great force, and if infection is present, may expose the operator to great danger. As a rule, the severance of two rings will be all that is necessary.

The after-treatment consists in keeping the patient in an even-tempered room with the atmosphere moistened with steam from a boiling kettle, covering the opening of the cannula with a veil of gauze. If the tube should become occluded with mucus, it should

be removed, cleansed and re-inserted. The tube should be disposed of as soon as possible.

If great pain is produced by feeding, a Jaque's catheter can be passed through the nose into the esophagus, and liquid food taken in that way.

In children, after three or four days, the inner tube should be removed, cleansed and re-inserted if necessary. Should the tube remain in the trachea for too long a time, there is great danger, as a result of loss of the faculty of breathing naturally, of the child becoming asphyxiated upon its removal.

The wound heals very rapidly, as a rule, by granulation. The parts should be brought into apposition by strips of adhesive plaster.

FIG. 163.—KILLIAN'S HEAD LAMP.

Granulations which sometimes form about the wound may be removed with a curette or scissors. The child should be given a liquid diet for a few days following the operation.

Tracheo-bronchoscopy.—Tracheo-bronchoscopy is subdivided

FIG. 164.—KILLIAN'S FOREIGN BODY HOOKS.

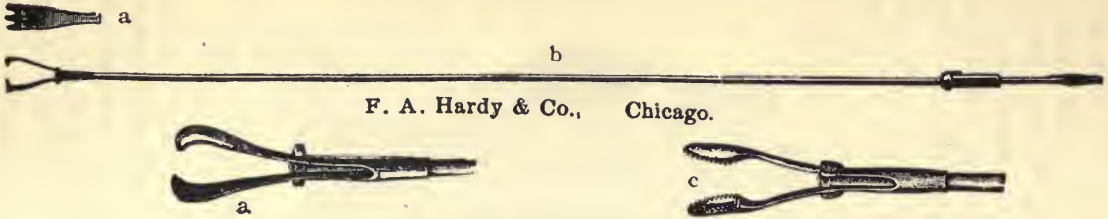

FIG. 165.—KILLIAN'S FOREIGN BODY FORCEPS.

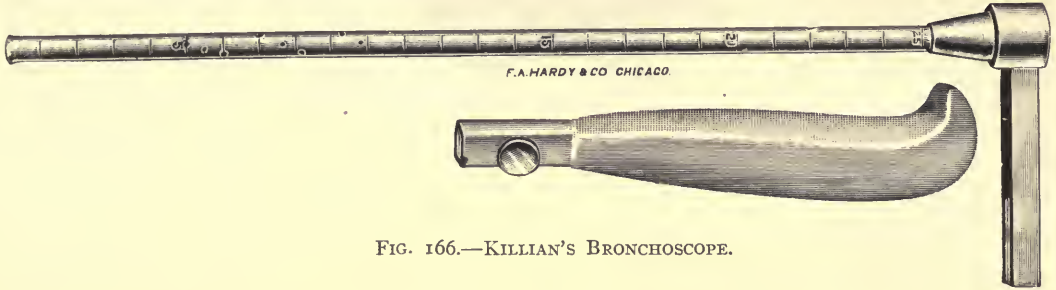

FIG. 166.—KILLIAN'S BRONCHOSCOPE.

into three distinct methods—simple upper direct tracheoscopy, tracheo-bronchoscopy proper, and lower tracheo-bronchoscopy.

Simple upper tracheoscopy is performed by placing the patient in an erect sitting position, and anesthetizing the pharynx, larynx, and trachea with a twenty per cent. solution of cocain. If in a child, chloroform anesthesia is necessary. The head is thrown well back, which brings the position of the mouth nearly on a direct line with the trachea. The short tube, as shown in the illustration, may be

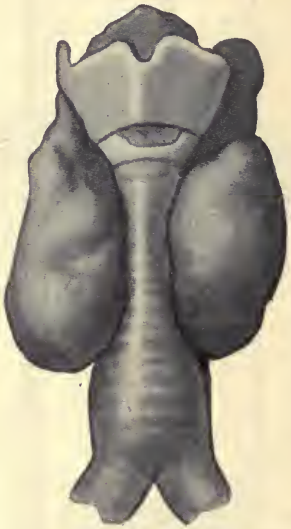

FIG. 167.—NARROWING OF THE TRACHEA FROM HYPERTROPHY OF THE THYROID GLANDS. (*Richardson.*)

passed over the epiglottis, as in Kirstein's autoscopy, directly into the trachea. By this method, as remarked by Killian (*The Laryngoscope*, December, 1906), we are not interfered with in our observation by the patient's lips, tongue, epiglottis, or vocal cords, and any constriction, granulations, cicatricial formations, ulcerations, benign or malignant neoplasms may be seen. Not alone intrinsic conditions are ascertained, but the effects of pressure of extrinsic

tumors (see Figure 168), or hypertrophies of the thymus or thyroid gland can thus be detected.

Congenital narrowing of the trachea from hypertrophy of the thyroid glands, as shown in Figure 169, can thus be detected. In cases with a large swelling of the thyroid glands, constriction of the trachea could not be discovered by palpation.

In the direct medication of the trachea, the short tube of Killian will be indispensable.

For tracheo-bronchoscopy proper, Killian recommends a general anesthetic, with the patient's head hanging over the edge of the

FIG. 168.—DEFLECTION OF THE TRACHEA FROM HYPERTROPHY OF THE THYROID GLAND. (*Richardson.*)

operating table, supported by the arm of an assistant. As an aid to the passage of the tracheo-bronchoscope, a tube-spatula divided into two parts, which enables its easy removal after the tracheo-bronchoscopy, is passed into the trachea.

The author desires, by way of comment on the tube-spatula of Killian, to direct the reader's attention to a tube-spatula designed

by Jackson, which is probably a simpler and more easily manipulated instrument.

The other instruments necessary for this operation, as recommended by Killian, are the Kirstein lamp (Fig. 163), Killian's tube forceps (Figs. 164, 165), the Killian bronchoscope (Fig. 166) and a mucus extracter. In addition to this, a small lamp on a carrier is recommended by Ingals.

With the patient in position, either the tube-spatula of Killian or Jackson is passed into the space behind the base of the tongue and epiglottis. By making firm pressure against the base of the tongue, the glottis is raised to a more direct line. The mucous membrane of the larynx and trachea is now washed with a twenty

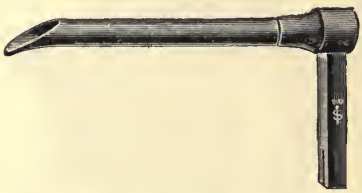

Fig. 169. Killian's Short Tube for Upper Direct Tracheoscopy.

per cent. solution of cocain in adrenalin. After a few minutes, the point of the spatula is passed under the epiglottis and held firmly in position. A proper sized tracheo-bronchoscopy tube is now inserted into the tube-spatula and passed into the trachea. The spatula tube is now withdrawn.

With the aid of a Killian lamp, the tube may be guided into the right or left bronchus.

With the specially designed grabbing forceps of Jackson, foreign bodies may be removed, or their absence noted.

The after-treatment of cases on which tracheo-bronchoscopy has been performed is rest in bed for twenty-four to forty-eight hours, liquid diet, and care against infection.

Lower bronchoscopy is much more simple, though hardly the ideal operation for inspection or removal of foreign bodies from the lung, trachea or bronchi. The scar resulting from tracheotomy is always a contraindication for the operation. It is claimed, however,

that infection of the lung from bacteria in the mouth and throat is not infrequent in upper tracheoscopy. There are, however, many conditions which may prevent a successful upper tracheoscopy, and, in consequence, lower bronchoscopy has been recommended by Killian, and for this, special instruments have been designed.

Following low tracheotomy, under chloroform narcosis, a short tube (resembling Fig. 169) with the aid of a speculum and under good illumination, is passed into the trachea. With the patient in the Rose position, with care the tube can be passed into either bronchus. With the aid of a Killian lamp or head-mirror, a good view is to be had, sufficient to enable an operator to secure any foreign body within the field of operation. The biting and extracting forceps are much shorter than those used for tracheo-bronchoscopy, and thus are more easily manipulated.

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